Journal of Environmental Health and Sustainable Development

The Relationship between House Type and Truck Traffic with Allergic Rhinitis in Adolescents

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ARTICLE INFO

ORIGINAL ARTICLE

Article History:
Received: 27 February 2023
Accepted: 20 May 2023

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Keywords:
Rhinitis, Allergic,
Adolescent,
Traffic-Related Pollution,
Home Environment.

ABSTRACT

Introduction: Although many studies have been conducted on allergic diseases, their risk factors including allergic rhinitis have not yet been fully understood. The present study aims to investigate the relationship between house type, floor, and frequency of truck traffic on the street of residences with allergic rhinitis in adolescents in Yazd.

Materials and Methods: This cross-sectional study was conducted on 5141 adolescents aged 13-14 years, from February 2020 to June 2020, using the large-scale Global Asthma Network (GAN) survey data in Yazd. The data were collected electronically using the GAN standard questionnaire, and analyzed in SPSS software version 23 using descriptive and analytical statistics (Chi-square and logistic regression). The value of $P < 0.05$ was considered significant.

Results: In this study, 11.2% of boys and 13.3% of girls had allergic rhinitis, indicating a significant difference by gender ($P = 0.025$). The prevalence of allergic rhinitis did not differ significantly according to the type of house (apartment or detached house with a yard) and the floor ($P > 0.05$). However, the prevalence of allergic rhinitis showed a significant correlation with the frequency of truck traffic on the street of residence ($P = 0.001$). If the truck passed through the street near the house almost all day, the chance of developing allergic rhinitis would be 2.4 times higher.

Conclusion: The risk of allergic rhinitis increases with the frequent truck traffic from the street near the house, but the type of house and floor do not have a significant effect.

Citation: Nafei Z, Salmani N, Behniafard N. ***The Relationship between House Type and Truck Traffic with Allergic Rhinitis in Adolescents.*** J Environ Health Sustain Dev. 2023; 8(2): 1962-9.

Introduction

Allergic diseases have increased dramatically as a serious public health problem over the past few decades [1]. The prevalence of rhinoconjunctivitis was 14.6% in the International Study of Asthma and Allergy in Children (ISAAC) in 2003, which was conducted in 98 countries, [2]. A systematic review in 2020 reported the prevalence of allergic rhinitis in Iranian children and adolescents to be 18% and 25%, respectively [3].

Allergic rhinitis is known as a risk factor for developing asthma. Approximately 40% of patients with allergic rhinitis report asthma symptoms and 80% of asthma patients have symptoms of allergic rhinitis [4].

Allergic rhinitis can be caused by a wide range of indoor and outdoor allergens [5]. The role of other factors such as sex, race, use of paracetamol, use of antibiotics, wood-burning cooking, exposure to cigarette smoke, birth weight, breastfeeding, body mass index (BMI), diet, and family size has also been discussed in the occurrence of the disease [3, 6].

[DOR: 20.1001.1.24766267.2023.8.2.3.1]
[DOI: 10.18502/jehsd.v8i2.13043]

However, despite numerous studies, the risk factors of allergic rhinitis have not yet been fully understood. One of the neglected risk factors is the type of house, the available data of which is limited [7].

In this regard, Çobanoğlu et al., in a study on adolescents aged 12-15 in Trabzon, Turkey, proposed that living in an apartment was a risk factor for rhinitis and reported that the prevalence rates of allergic rhinitis in students living in apartments and detached houses were 15.4% and 8.4%, respectively [8]. Wang J, et al. also reported that the incidence of rhinitis and respiratory infectious diseases is related to some indoor factors. The age of buildings, building dampness and condensation on window panes and odor at home may be some of the risk factors [9].

Recent studies have focused on air pollution caused by traffic that can affect people's health and cause allergic reactions [10-12]. In epidemiological studies, nitrogen dioxide and particulate matter have been investigated as effective pollutants caused by truck traffic in allergic diseases [10, 13]. Due to the relative immaturity of the immune and respiratory systems [14, 15], being more outdoors and breathing more (children breathe about 50% more air per kilogram of body weight), children are exposed to relatively higher doses of environmental pollutants compared to adults, and thus, suffer more from the health effects of air pollution [16]. Several studies on the relationship between pollution caused by truck traffic and exacerbation of respiratory and allergic diseases in children have inconsistent results [17-20]. A study by Yi SJ, et al. showed that proximity to truck traffic can result in the incidence of atopic eczema, but it is not related to asthma and rhinitis [21]. A cohort study on 14-16-year-old adolescents stated that with increased exposure to nitrogen oxide and fine dust caused by truck traffic, the risk of developing asthma has increased, but it has no effect on the incidence of rhinoconjunctivitis [22]. Jung et al. reported an inverse relationship between the distance of the residence place from the main road for truck traffic and the incidence of allergic rhinitis in children aged 6-14 years [23].

Considering that most of the studies related to truck traffic have been done in industrialized countries, and a significant number of the trucks in developing countries are old, pollution caused by them is more in these countries. Also, dusty and dirt roads are more common in developing countries, and course particles from these roads can have destructive effects on airways [19, 24]. Therefore, the need for more research regarding the effect of truck traffic on the occurrence of allergic rhinitis in Iran as a developing country is emphasized. The present study was conducted to investigate the relationship between the type of house and proximity to truck traffic with the incidence of allergic rhinitis in 13-14-year-old adolescents in Yazd.

Materials and Methods

Study area and sample collection

The current cross-sectional descriptive study used data from the Global Asthma Network (GAN) and was conducted from February 2020 to June 2020 in Yazd on 5141 adolescents aged 13 to 14 years. Sampling was done by cluster method using the GAN standard questionnaire derived from the standard questionnaire of ISAAC. The details of the study method have already been published [25].

The electronic questionnaire was placed in the virtual education groups of students due to the closure of schools during the COVID-19 pandemic. All the selected students aged 13-14 years were asked to complete the questionnaire. The informed consent form was at the beginning of the electronic questionnaire and every student was completely free to participate in the research.

Definition of items

Allergic rhinitis: Nasal problems (sneezing or runny nose or nasal obstruction without a cold) along with nasal itching in the last 12 months.

Rhinoconjunctivitis: Nasal problems with itchy eyes in the past 12 months.

Severe rhinoconjunctivitis: Rhinoconjunctivitis that significantly interferes with daily activities in the past 12 months.

Truck traffic: The number of times trucks pass through the street or alley where the students'

[DOR: 20.1001.1.24766267.2023.8.2.3.1]
[DOI: 10.18502/jehsd.v8i2.13043]

houses were located was asked (Never, Seldom, Frequently, and Almost all day).

Statistical analysis

The collected data were analyzed by SPSS software version 23. The studied parameters were analyzed using descriptive and analytical statistics, including Chi-square statistical test and logistic regression. P-value < 0.05 was considered statistically significant.

Ethical issue

The ethical approval of the study was separately provided by the Ethics Committee of Shahid Sadoughi University of Medical Sciences, Yazd (IR.SSU.REC.1400.109).

Results

In this study, 5141 students aged 13-14 years were investigated which 59.7% of them were females. Moreover, 64.8% lived in detached houses with a yard and 50.4% lived on the ground floor. Regarding the amount of truck traffic, 14.6% of the students reported several times a day and 4% reported almost all day (Table 1).

The results showed that 12.4%, 10.5%, and 0.2% of the students had allergic rhinitis, rhinoconjunctivitis, and severe rhinoconjunctivitis, respectively. None of the above items had a significant relationship with house type and floor (Table 2), while all of them had a significant relationship with truck traffic (P = 0.001). The chance of developing severe rhinoconjunctivitis increased 21 times when there was truck traffic almost all day long on the street near the house. Also, the use of adjusted logistic regression showed that with the presence of gender variable, truck traffic as a factor increasing the chance of severe rhinoconjunctivitis maintains its effect (Table 3).

The present study revealed that 11.2% of the male and 13.3% of the female entrants had allergic rhinitis, and the Chi-square test showed a significant difference between the two genders (P = 0.025).

Logistic regression was used to determine the incidence of allergic rhinitis according to gender and truck traffic. According to the results, female gender increases the chance of allergic rhinitis by 21%. In addition, the probability of developing allergic rhinitis increases 2.4 times, when there is truck traffic almost all day long on the street near the house. Using adjusted logistic regression for the gender variable also revealed that the amount of truck traffic maintained its effect as a factor in increasing the chance of allergic rhinitis (Table 4).

In this study, there was a significant difference in the frequency of allergic rhinitis between genders (P = 0.001), i.e. females were affected more than males. The frequency of rhinoconjunctivitis (P = 0.3) and severe rhinoconjunctivitis (P = 0.09) did not indicate a significant difference between genders.

Table 1: Variables related to residence and demographic data of 13-14-year-old subjectsin Yazd

Variable		Frequency (percentage)
Gender	Female	3069 (59.7%)
	Male	2072 (40.3%)
Place of residence	Apartment	1811 (35.2%)
	Detached house	3330 (64.8%)
Floor	Underground	375 (7.3%)
	Ground floor	2589 (50.4%)
	Other floors	2177 (42.3%)
Truck traffic	Never	1104 (21.5%)
	Seldom	3078 (59.9%)
	Frequently	753 (14.6%)
	Almost whole day	206 (4%)

[DOR: 20.1001.1.24766267.2023.8.2.3.1]
[DOI: 10.18502/jehsd.v8i2.13043]

Table 2: Allergic rhinitis, rhinoconjunctivitis, and rhinoconjunctivitisseverity according to type and floor of residence among 13-14-year-old subjects in Yazd

Variable		Frequency (percentage)	P-value
Allergic rhinitis			
Place of residence	Apartment	229 (12.6%)	0.9
	Detached house	411 (12.3%)	
Floor	Underground	46 (12.3%)	0.4
	Ground floor	306 (11.8%)	
	Other floors	288 (13.2%)	
Rhinoconjunctivitis			
Place of residence	Apartment	187 (10.3%)	0.9
	Detached house	352 (10.6%)	
Floor	Underground	37 (9.9%)	0.5
	Ground floor	272 (10.5%)	
	Other floors	230 (10.6%)	
Severe rhinoconjunctivitis			
Place of residence	Apartment	4 (0.2%)	0.6
	Detached house	4 (0.2%)	
Floor	Underground	1 (0.3%)	0.6
	Ground floor	7 (0.3%)	
	Other floors	4 (0.2%)	

Table 3: Allergic rhinitis, rhinoconjunctivitis, and rhinoconjunctivitisseverity according to truck traffic along with logistic regression analysis in 13-14-year-old subjects in Yazd

Variable		Frequency (percentage)	P-value	OR (95% CI)	Adjusted OR (95% CI) (gender)
Allergic rhinitis					-
How often do trucks pass?	Never	99 (8.3%)		1	
	Seldom	379 (12.3%)	0.001	0.64(0.0-51.82)	
	Frequently	131 (17.4%)		0.43(0.0-32.57)	
	Almost whole day	38 (18.4%)		0.40(0.0-26.60)	
Rhinoconjunctivitis					
How often do trucks pass?	Never	85 (7.7%)		1	
	Seldom	324 (10.5%)	0.001	0.70(0.0-55.91)	-
	Frequently	99 (1.13%)		0.55(0.0-40.74)	
	Almost whole day	31 (15%)		0.47(0.0-30.73)	
Severe rhinoconjunctivitis					
How often do trucks pass?	Never	1 (0.1%)		1	1
	Seldom	6 (0.2%)	0.001	2.1(0.17-25.9)	2.1(0.17-25.9)
	Frequently	1 (0.1%)		1.4(0.23- 09.48)	1.4(0.23- 09.5)
	Almost whole day	4 (1.9%)		21.8(2.196- 42.4)	21.82 (2.196-4.3)

[DOR: 20.1001.1.24766267.2023.8.2.3.1]
[DOI: 10.18502/jehsd.v8i2.13043]

Table 4: Allergic rhinitis according to demographic variables along with logistic regression analysis and adjusted logistic regression in 13-14-year-old subjects in Yazd

Variable		Frequency (percentage)	P-value	OR (95% CI)	Adjusted OR (95% CI) Sex*
Allergic rhinitis					
Gender	Female	408 (13.3%)	0.02	1.21 (1.1-02.44)	
	Male	232 (11.2%)			-
Allergic rhinitis					
Residence place	Apartment	229 (12.6%)	0.9		
	Detached house	411 (12.3%)		-	-
Allergic rhinitis					
Floor	Underground	46 (12.3%)	0.4		
	Ground floor	306 (11.8%)		-	-
	Other floors	288 (13.2%)			
Allergic rhinitis					
How often do trucks pass?	Never	92 (8.3%)	0.001	1	1
	Seldom	379 (12.3%)		1.54(1.1-21.96)	1.56(1.1-23.98)
	Frequently	131 (17.4%)		2.3(1.3-74.08)	2.3(1.3-78.16)
	Almost whole day	38 (18.4%)		2.4(1.3-64.7)	2.5(1.3-68.83)

***** Using adjusted logistic regression for gender variable to investigate the effect of truck traffic on increasing the odds of allergic rhinitis

Discussion

This study indicated that the prevalence rates of allergic rhinitis, rhinoconjunctivitis, and severe rhinoconjunctivitis do not differ significantly according to house type and floor. However, in some studies, living in an apartment has been identified as a risk factor for allergic diseases [12, 26, 27]. The excessive concentration of allergens in apartments, such as cockroach allergens, as well as the inability to control the building quality by the residents of each unit can be the reason for the increase in risk [28-30]. Some studies consider the absence of air conditioners in apartments as justification for this result [31, 32]. The difference in the architectural style of the building, the materials used based on the climate and culture of the region, climate diversity, population density in apartments, and living in different urban areas (center or outskirts of the city) are the causes of varied results in different studies.

The present study showed that the probability of allergic rhinitis increased 2.4 times when trucks passed on the street of residence almost all day.

This finding is consistent with the results of the study by Chinratanapisit et al., who found that occasional and constant truck traffic on the street of residence increased the probability of allergic rhinitis by 25% and 62%, respectively [33]. Shirinde et al. also reported that truck traffic near a residence increases the incidence rate of rhinitis by 60% and rhinoconjunctivitis by 42% [20]. In the ISAAC phase three, which was conducted globally on two age groups, 6-7 years and 13-14 years, a positive relationship was identified between the occurrence of asthma symptoms, rhinoconjunctivitis, and eczema with truck traffic [19]. In Germany, a study in 2004 on subjects aged 6-7 and 13-14 years old indicated that very little exposure to truck traffic increases the incidence of allergic rhinitis by 29%, frequent exposure by 33%, and continuous exposure by 81% [34]. The results of the study by Spengler et al. also showed that the proximity of the house to the traffic area of trucks increases the incidence of cough and respiratory allergy. It also increases the incidence of eye itch by 31%, respiratory allergy by 41%, and bronchitis by 19% [35]. With the increase in truck traffic, the concentration of nitrogen oxide and black carbon increases, which, along with the particles emitted from diesel trucks, affects the

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immune system causing allergic sensitivity [24, 36, 37]. Zuraimi et al. also introduced the increase in traffic load as a factor increasing the symptoms of rhinoconjunctivitis, which is consistent with the present study [38].

One of the limitations of the current study is that the findings were solely based on the self-report of 13-14-year-old teenagers; and other methods have not been used to confirm allergic rhinitis, such as skin prick test or measurement of specific immunoglobulin E levels. Also, the amount of traffic in the streets near the houses was measured only based on self-reports of the subjects and no index was used to measure the amount of truck traffic or to measure the pollutants caused by the traffic of trucks in the residential area. Furthermore, recall bias is another limitation of the current study. Since the information related to the place of residence, such as location, age of the residential house, the number of floors, and the residents of the apartment, is not given in the questionnaire, it may be effective as a confounding factor.

Conclusion

The results of the study showed that the incidence of allergic rhinitis, rhinoconjunctivitis and severe rhinoconjunctivitis in ages of 13 to 14 years increases with the increase in the traffic of trucks near houses. However, no relationship was found regarding the type of house and floor.

Acknowledgments

This article was carried out using the data of the large study of the Global Asthma Network in Yazd during 2019-2020 and was approved by the Research and Technology Vice-Chancellor of Shahid Sadoughi University of Medical Sciences in Yazd and with the ethical code of IR.SSU.REC.1400.109. The authors are grateful to the students who participated in this project, the School Health Unit, Shahid Sadoughi University of Medical Sciences, Yazd, and the General Directorate of Education, Yazd.

Funding

This study was financially supported by the Vice Chancellor of Research and Technology of Shahid Sadoughi University of Medical Sciences.

Conflict of interest

The authors have no conflict of interest for the publication of this article.

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