The Prevalence of Allergic Rhinitis and It's Relationship With Second-Hand Tobacco Smoke Among Adults in Iran

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Abstract- To determine the prevalence of allergic rhinitis (AR) among adult residents and investigate whether second-hand tobacco smoke (SHS) is correlated with AR as one of the global health problems and one of the most common respiratory disorders reducing the quality of life. A telephone interview survey was conducted by calling 16500 randomly selected telephone numbers from 22 regional telecommunications of Tehran (capital city of Iran) in 2010. A modified European Community Respiratory Health Survey (ECRHS) questionnaire was completed for adults aged between 20 to 44-year-old. Two questions about active smoking and being exposed to SHS were added to the questionnaire. five thousands five hundred cases (76.92%) responded to our calls among 7150 eligible telephone numbers. The gender of study population included 3412 female (62%) and 2088 male (38%) with the mean±SD age of 31.15±7.33. The prevalence of AR was 26.7%. There were no significant relationship between active smoking and AR; while a significant relationship was detected between SHS and AR among our participants (P=0.02). However, no significant difference was found between men and women. In addition, more than 50% of adults suffering from AR, showed significant symptoms of asthma (P<0.001). The results of the current study revealed that the prevalence of AR was higher in Iran compared to other countries worldwide and SHS may be considered as a serious risk factor for AR.

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Keywords: Prevalence; Allergic rhinitis; Adults; Smoking; Iran

Introduction

Allergic rhinitis (AR) is known as one of the most common respiratory disorders with a high prevalence in many western countries (1). It is a global health problem (2,3) that causes a considerable impairment in quality of life and social activities (4). The co-morbidity of asthma and rhinitis has led to the concept of "one airway, one disease". It has been shown that treatment of rhinitis in patients with persistent AR and uncontrolled asthma results to a better control of asthma as well (5).

The prevalence of AR has increased during the past 50 years. According to a conservative estimation, 500 million people around the world suffer from AR with the prevalence of about 10-25% in adults and up to 40% in children (1,6). The prevalence of allergic rhinitis varies in different Asian countries although it is going to be rising up to 45% (7).

Second-hand smoke (SHS) and environmental exposure are associated with lower respiratory symptoms, asthma, and decrements in lung function. The risk of chronic rhinitis may be increased by both active smoking and SHS (8,9). However conflicting results were obtained regarding the effect of active smoking and exposure to SHS on AR. There are a few studies on the prevalence of AR in Iran (10,11). However, the relationship between active smoking or SHS exposure and AR was not evaluated in Iran as one of the Eastern developing countries.

The aims of this study were to evaluate the prevalence of AR among adult Iranian people, assess the co-morbidity of AR and asthma, and determine the relationship between AR and smoking behavior.

Materials and Methods

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Study design

This cross-sectional telephone interview study was conducted during the first six-month of 2010 in Tehran (Capital city of Iran), using the questionnaire form of The European Community Respiratory Health Survey (ECRHS) (12). This study was approved by the research ethics committee of Immunology, Asthma, and Allergy Research Institute (Tehran University of Medical Sciences). After explaining the study design at the time of telephone interview, explicit verbal consent was obtained from all study participants before administering the questionnaire. All participants were assured that all personal information would be kept private.

The target population consisted of subjects having fixed-line telephones in Tehran. From 22 regional telecommunications of Tehran, we randomly selected 16500 telephone numbers with equal distribution in all regions in order to avoid selection bias. We conducted the approach of random digital dialing (RDD) via computer for sampling target telephone numbers. Based on the prevalence of asthma and AR in Iran which is about 7 and 25%, respectively the sample size was calculated with the below-mentioned formula. Considering the probability of failed telephone response and with regard to efficiency of about 30% in telephone surveys compared to random sampling, the sample size was tripled to 16,000 telephone numbers and finally was determined.

$$n = Z^{2}_{1-\frac{\alpha}{2}} \frac{p \times (1-p)}{d^{2}} = 5350$$

5350×3=16050

If the line was busy or there was no response, a maximum of three repeat calls would be undertaken. Proxy interviews were not allowed. The last updated version of short ECRHS questionnaire was applied from which a total of 11 questions were used. One trained general practitioner was calling the selected numbers and inviting the adult persons aged 20-44 years to answer the questions. Interviews were conducted using a Persian description of the ECRHS questionnaire on AR symptoms and additional questions on smoking behaviors by two trained general physicians that applied the same description for all participants and decrease the potential bias. A positive response to the following question was defined as exposure to SHS: Have you been regularly exposed to inhalation of SHS during the last 12 months. This definition was previously applied in the Swiss Cohort Study on Air Pollution and Lung and Heart Diseases in Adults (SAPALDIA) (13,14). Also, two criteria with a high score of sensitivity and specificity were considered as the indicators of asthma: 1) wheezing with breathlessness and 2) wheezing with two nocturnal symptoms (13,14).

Statistic analysis

The data were analyzed using the statistical software SPSS, Version 17 (SPSS Inc., Chicago, IL, USA). Accordingly, the prevalence of each symptom was calculated. A comparison between the groups was made using the chi-squared test and a $P<0.05$ was considered statistically significant.

Results

Of 16500 randomly selected and dialed telephone numbers, 7150 numbers were eligible and answered the call. Regarding the 1650 cases who did not concern for interview, the response rate of our study was 76.92% (5500 participants). The mean±SD age of participants was 31.15±7.33 years with a range between 20 and 44 years. Of the 5500 participants in this cross-sectional study, 3410 (62%) were female and 2090 (38%) male.

Of all participants, 26.7% had AR with the gender distribution of 64% for female and 36% for male. However, there were no significant gender differences among participants in terms of nasal allergy symptoms ($P>0.05$). Additionally, the comorbidity of AR and asthma was significantly high ($P<0.001$), as compared to non-asthmatic patients. Briefly, a significant relationship was detected between AR and asthma in all subgroups of asthmatic participants including patients with wheezing+breathlessness ($P<0.001$), wheezing+two nocturnal symptoms ($P<0.001$), and current asthma ($P<0.001$) compared to healthy individuals (Table1).

Table 1. Categorized participants based on nasal allergy or asthma symptoms

Asthma symptoms (%)	Nasal allergy (%)	
	Yes*	No*
Wheezing with breathlessness	56.9	37.2
Wheezing with two nocturnal Symptoms (cough, dyspnea)	51.8	48.2
Current asthma **	76.8	23.2

* within nasal allergy group

** "Current asthma" was defined by positive response either to "attack of asthma" or "use of medication for asthma " questions

Among 5500 participants in this study, 11.9% were active smokers, and 16.5% were exposed to SHS; while 71.6% were nonsmoker participants. In the non-smoker group, 2696 participants were females (68.46%), and 1242 were male (31.53%); while in the active smoker group 101 individuals were female (15.44%) and 553 were male (84.55%). However, the majority of participants in the passive smoker group were female (n=615, 67.73%); compared to males (n=293, 32.26%). Among the active smokers, 34% of males and 3.5% of females had a smoking habit of smoking more than 10 cigarettes per day. In spite of the fact that no significant relationship was detected between active smoking and AR; the relationship between SHS and AR was significant among our participants (P=0.02) with no significant difference among genders (Table 2). More importantly, the odds ratio (OR) calculation indicated that the probability of developing AR in patients with exposure to SHS increased 1.2 times more than active smoker participants (OR=1.2 with 95% CI=1.05-1.44).

Table 2. Categorized participants based on nasal allergy and smoking behavior

Smoking / Nasal allergy	Non smoker (%)	Active smoker (%)	Passive smoker (%)
Yes*	70	11.2	18.8
No*	72.2	12.2	15.7

* within nasal allergy group

Discussion

The present study revealed a high prevalence of AR among adults in Tehran as compared to other countries worldwide with a high comorbidity of AR and asthma. Additionally, in spite of the fact that no relationship was found between AR and active smoking, a significant relationship was detected between SHS exposure and AR prevalence.

The worldwide incidence and prevalence of AR have increased since at least 1990 in almost all westernized countries (15). According to the results of a telephone survey conducted by Zhang *et al.,* in eleven major cities of China, the prevalence of AR had a wide variation, and 26% of the self-reported AR subjects had persistent AR (16). Despite widely different allergic disorder prevalence in Asia, the prevalence of AR is gradually increasing over the time both in pediatric and adult population (from 5% to 45%) (7,17). There are a few reports of prevalence of AR in Iran. Varasteh *et al.,* estimated that the prevalence of AR was about 27% in Mashhad (a big city in the northeast of Iran) which was similar to the result of our study (26.7%) (11).

Cigarette smoke is a common irritant of sino-nasal epithelial cells by triggering the innate immune system and impacting the cytotoxic effects (18). However, controversies exist regarding the relationship between exposure to SHS or active smoking and AR. Higgins *et al.,* suggested that both active smoking and being exposed to SHS increase the risk of chronic rhinitis (9). In the recent study of Pallasaho *et al.,* exposure to SHS and family history of AR were associated with rhinitis symptoms without atopy (19). Another study showed that SHS was associated with increased prevalence of rhinitis symptoms in the US adult patients (20).

Similar results were obtained by Montefort and *et al.,* on the severe adverse effects of SHS on the allergic condition in Maltese children (21). Similarly, clinical manifestations of allergic diseases were more frequent both in active smokers and individuals exposed to SHS than in nonsmokers (22). These results were in accordance with the outcomes of the current study in which we found a significant relationship (P=0.02) between SHS and nasal allergy. A recent systematic review found a decreased risk of AR in adults with active smoking (23). Our results are in agreement with this finding as we found that no relationship was found between AR and current smokers with respect those exposed to SHS.

Several parameters can affect the incidence rate of AR including the study criteria, the age of participants, differences in survey methods, different geographic locations and socioeconomic status. Each of them would be solely enough to complicate the comparison between different studies (24). In opposite to our study, Salehi *et al.,* did not observe any relationship between SHS and AR in children (25) that may be attributed to different ages of patients in these two studies. A recent study conducted in Swiss revealed that there is no significant relationship between SHS or obesity with AR or non-allergic rhinitis in adult patients (26). On the other hand, even potentially reverse relationship was detected between SHS exposure and mean IgE level (27). Additionally, a 32-year longitudinal study in New

Zealand demonstrated no significant relationship between SHS exposure and allergic manifestations (28). Interestingly, another cross-sectional study in adults in Italy showed that AR was less prevalent in current smokers, while the prevalence of nonallergic rhinitis was higher in current and ex-smokers (29). These controversies may be attributed to different methods compared AR and nonallergic rhinitis.

Epidemiological studies have revealed that some lifestyle aspects including smoking, air pollution, and urban living are likely to be the most important factors of increasing in allergic diseases (2). Nevertheless, the specific mechanism for the relationship between AR and SHS exposure has not been proven (30). According to the report of Varasteh *et al*., it seems that higher prevalence of AR in big cities can be somehow affected by air pollution as an outdoor risk factor. Obviously, increasing in automobile or diesel exhaust fumes as well as the rise of industrial factories in these cities especially Tehran as the capital city of Iran, are the most important factors of air pollution. Considering the fact that avoidance of SHS and environmental pollutions are obviously desirable for both individual and public health purposes, we would expect these measures to have a significant effect on the risk of AR.

A considerable relationship (50%) between AR and asthma was also established in our study which is in accordance with the other reports indicating the coexisting of asthma and rhinitis. According to another study on co-morbidity of AR and asthma in Taiwanese, 69.9% of asthmatic patients suffered from AR while 8.4% of them were undiagnosed, and 37.9% of them were left untreated for their rhinitis (31).

Despite being a global health problem, there are insufficient epidemiological data on AR and asthma. Therefore, it needs to gather adequate data concerning their etiology, relating risk factors and natural triggers. Allergic Rhinitis and its Impact on Asthma (ARIA) should be considered as an alarm in all patients with rhinitis for serious evaluation of the efficacy of treatment protocols (32). Obviously, complete and effective treatment of rhinitis may improve asthma symptoms.

This study revealed that there was no relationship between active smoking and AR per se, while the relationship between SHS and AR was significant. However, this cross-sectional study has several limitations. In view of the fact that no specific IgE assessment such as skin prick test was conducted, some of the subjects may have been incorrectly categorized and the results may be less evident. In addition, AR and SHS exposure was self-reported and may be prone to recall bias. Nevertheless, we expect that recall bias would be similar in patients exposed and those unexposed to SHS. Another limitation is that no physician visit was performed for more accurate diagnosis of AR. Regarding the fact that the present analysis is cross-sectional clear establishment of the sequence of events is not possible unless for early life exposures. Additionally, it is unclear if SHS exposure is associated with the onset AR or if it only triggers symptoms of an existing AR. One of the important limitation of the current study is that Persian description was applied while filling the original questionnaire. We tried to decrease this limitation by applying two trained general practitioner; however, translated and validated questionnaires are more appropriate for such studies. Another limitation of the current study is that the level of air pollution in different areas of Tehran is different which may highly influence the indicators of both asthma and AR. Considering the fact that the migration rate is quite high in a city like Tehran and the living area is not stable in the majority of people, we tried to overcome this limitation by equal distribution of participants in all regions. Considering the fact that the efficiency of telephone survey is less than random sampling, further longitudinal data are needed to prove the suggestive evidence of an interaction between SHS, asthma, and AR in other big cities of Iran with industrial air pollution as well as suburban towns with low air pollution to draw firm conclusions.

The results showed a significant relationship between SHS and AR. This survey also emphasized on AR as a risk factor for asthma. Hence, early diagnosis and complete treatment of AR may help the patients to prevent asthma or improve the symptoms. More importantly, community awareness should be raised about the effects of smoking on asthma and AR, and the society should be trained for smoking cessation and smoking ban policies in public.

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