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Environmental factors associated with allergic rhinitis symptoms in Japanese university students: A cross-sectional study

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ABSTRACT

Objective: Numerous studies have reported that various environmental factors during early life are key determinants for developing allergic disease. Herein, we aimed to investigate the impact of environmental factors on allergic rhinitis.

Methods: This cross-sectional study was conducted in a single university in Japan (from April to June, in 2015 and 2016). Students voluntarily answered online questionnaires regarding their allergic rhinitis symptoms and their exposure to various environmental factors during preschool-age.

Results: Overall, 3075 students participated the questionnaire. After excluding those with incomplete datasets, 3016 students were eligible. Of these, 49% had allergic rhinitis symptoms. Female sex was associated with a lower risk of allergic rhinitis symptoms (odds ratio [OR], 0.82; 95% confidence interval [CI], 0.68–0.99). Comorbidity of asthma or atopic dermatitis and a family history of allergy (asthma, atopic dermatitis, or allergic rhinitis) were associated with higher risks of allergic rhinitis symptoms. Regarding the number of household members, compared with subjects with <3 people, those with 5 (OR, 0.74; 95% CI, 0.57–0.97) and ≥6 people (OR, 0.66; 95% CI, 0.49–0.88) in their household showed lower incidences of allergic rhinitis symptoms. No other environmental factors, including birth order, number of siblings, living environment, passive smoking, furry pet ownership, housing, bedding, breastfeeding, dairy product intake, preschool setting, and starting age of preschool, was associated with the incidence of allergic rhinitis symptoms.

Conclusion: Sex, current asthma and atopic dermatitis symptoms, family history of allergies, and the number of people in the household at preschool-age were associated with the incidence of allergic rhinitis symptoms.

1. Introduction

Allergic rhinitis is one of the most common diseases in industrialized countries [1–3], affecting 10–40% of the population in these countries, and its prevalence has markedly increased in recent decades [4,5]. Allergic rhinitis symptoms such as rhinorrhea, sneezing, nasal obstruction, and nasal itching usually lower the quality of life [6]. In fact, millions of people have been reported to experience physical impairments and reductions in quality of life, as well as economic burdens, derived from rhinitis and its associated comorbidities [1].

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The development of allergic rhinitis is affected by hereditary and environmental factors [7,8]. In particular, early-life exposure can interact with the child's genotype and affect the response to environmental factors [9,10]. Therefore, environmental factors during one's early life can be key determinants of the development of allergic disease.

Numerous previous studies have reported that environmental factors are associated with the incidence of allergic rhinitis [7]. However, the impact of individual environmental factors on disease onset is still a matter of debate. For example, some studies have reported that male sex [11], passive smoking [12,13], and lack of breastfeeding [14] are risk factors for the occurrence of allergic rhinitis, whereas other studies displayed insignificant results for these factors [11,15,16].

In the present study, we investigated the association between environmental factors in early childhood and allergic rhinitis symptoms among Japanese university students.

2. Methods

2.1. Study participants and procedures

This cross-sectional study was conducted at The University of Tokyo, Japan, from April to June in 2015 and 2016. Students were encouraged to participate in the study when they received their annual medical checkup at the beginning of each fiscal year (April).

Students who voluntarily agreed to participate in the survey accessed a website of questionnaires, formatted using the Google Form web service. The participants answered consecutive questions about (i) symptoms of allergic rhinitis, asthma, and atopic dermatitis; (ii) background characteristics; and (iii) environmental factors in early childhood, especially during preschool-age.

2.2. Definition of symptoms of allergic rhinitis, asthma, and atopic dermatitis

Allergic rhinitis symptoms were defined using the Japanese version of the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire [17]. We classified participants as having "current allergic rhinitis symptoms" when they answered "Yes" to both of the following questions: "In the past 12 months, have you had a problem with sneezing or a runny or blocked nose when you DID NOT have a cold or the flu?" and "In the past 12 months, has this nose problem been accompanied by itchy-watery eyes?" In addition, we asked about the months when the symptoms of allergic rhinitis were present. We also classified the participants as having "current asthma" when they answered "Yes" to the question "Have you had wheezing or whistling in the chest in the last 12 months?" and as having "current atopic dermatitis" when they answered "Yes" to both of the following questions: "Have you had an itchy rash at any time in the last 12 months?" and "Has this itchy rash at any time affected any of the following places: the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears, or eyes?"

2.3. Assessment of environmental status in early childhood

We assessed the participants' background characteristics and environmental factors in early childhood by asking consecutive questions about their family history of allergic disease and main status of environmental factors, especially during preschool age. This questionnaire for environmental factors included the following: birth order, number of siblings, number of people living in their household, living environment (rural, suburb, or urban), exposure to passive smoking, furry pets in the home, housing (single family house or housing complex), bedding (bed on wooden floor or futon on a tatami mat [Japanese style bedding]), feeding during infancy (breastfeeding, mixed, or artificial), dairy product intake (everyday, sometimes, or rarely), preschool setting (nursery school or kindergarten), age when starting preschool (in years), history of tonsillectomy, and vaccination status (varicella, measles, rubella, mumps, and bacillus Calmette-Guérin).

2.4. Statistical analyses

Categorical variables are presented as the number of students (percentage). The chi-squared test was used to analyze associations of allergic rhinitis symptoms with participant characteristics and environmental factors. Multivariate logistic regression analysis was performed to evaluate the effect of the environmental factors on allergic rhinitis symptoms after adjustment for potential confounders.

All analyses were performed using Statflex version 6.0 (Artech Co., Ltd., Osaka, Japan). Statistical significance was set as a P value of less than 0.05.

2.5. Ethical considerations

This study was approved by the ethical committee of The University of *****, Graduate School of Medicine (approval no. 14-168). Informed consent was waived owing to the voluntary participation in the survey.

3. Results

In total, 3075 students (12% of the students attending the university) answered the questionnaires. After excluding those with incomplete datasets, data from 3016 students were evaluated. Overall, 1475 (49%), 236 (8%), and 745 (25%) students reported to have current allergic rhinitis, asthma, and atopic dermatitis symptoms, respectively.

Table 1 shows the participants' characteristics and environmental factors in early childhood among participants with and without allergic rhinitis symptoms. Current allergic rhinitis symptoms were more frequent in male participants (50.2% vs. 45%, $p = 0.012$) and in participants with a parental history of allergies (61.6% vs. 41%, $p < 0.001$) or a history of allergies in their siblings (57.6% vs. 45.3%, $p < 0.001$). Factors significantly associated with allergic rhinitis symptoms included current asthma and/or atopic dermatitis status, number of siblings, birth order, number of people in their household, living environment, school settings, and starting age of preschool.

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