Original article

Rhinitis in Swiss adults is associated with asthma and early life factors, but not second hand tobacco smoke or obesity

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ABSTRACT

Background: Second hand tobacco smoke (SHS) and overweight/obesity are risk factors for asthma and lower airway respiratory symptoms. We investigated whether SHS or overweight/obesity were also associated with allergic or non-allergic rhinitis.
Methods: Cross-sectional data were obtained during the second SAPALDIA Study. Interviewer administered questionnaires were completed by 8047 participants from 8 communities in Switzerland. Blood was collected from 5841 participants and tested for allergen specific IgE. Allergic rhinitis was defined as nasal symptoms with detectable IgE. Data were analysed by multinomial logistic regression with four outcome categories defined according to the presence or absence of rhinitis and/or atopy.
Results: The prevalence of allergic rhinitis was 885 (15.2%) and non-allergic rhinitis 323 (5.5%). The risk of allergic rhinitis was increased in subjects with physician diagnosed asthma (Relative Risk Ratio 6.81; 95%CI 5.39, 8.6), maternal atopy (1.56; 1.27, 1.92) and paternal atopy (1.41; 1.11, 1.79). Older subjects were at lower risk (0.96; 0.95,0.97 per year), as were those raised on a farm (0.64; 0.49,0.84), with older siblings (0.92; 0.86,0.97 per sib) or from rural areas. The risk of non-allergic rhinitis was also increased in subjects with physician diagnosed asthma (4.02; 2.86, 5.67), reduced in males (0.59; 0.46, 0.77), but not associated with upbringing on a farm or older siblings. There were no significant associations of SHS or overweight/obesity with either form of rhinitis.
Conclusions: Allergic and non-allergic rhinitis have different risk factors apart from asthma. There are significant regional variations within Switzerland, which are not explained by the factors examined.
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Introduction

Rhinitis is characterised by nasal symptoms such as rhinorrhoea, post-nasal drip, sneezing, obstruction and/or pruritus. The ARIA (Allergic Rhinitis in Asthma) classification[1] includes infectious, allergic, occupational, drug induced and hormonal rhinitis. There are also other rarer causes including the non-allergic rhinitis with eosinophilia syndrome, irritant, food-related and atrophic rhinitis. Epidemiological studies to date have focussed on allergic rhinitis,[2–4] which is highly prevalent in many Western countries[5] and causes considerable impairment of quality of life.[6] The median fraction attributable to atopy (population attributable risk) was 27%,[5] which means that other risk factors for rhinitis must also be important.

Second hand (or environmental tobacco) smoke (SHS) exposure is associated with lower respiratory symptoms, asthma and decrements in lung function. Both active smoking and SHS may increase the risk of chronic rhinitis.[7,8] However the results of studies of active and passive smoking on allergic rhinitis have been conflicting. Obesity and overweight are associated with lower respiratory symptoms and several studies have suggested that this increasingly common condition is associated with asthma, particularly non-allergic asthma.[9] This could provide a partial explanation for the increase in the prevalence of asthma that has been observed in Western countries over the last 50 years. Longitudinal analysis of data from the Tasmanian longitudinal Health Study (TAHS) found that adiposity at 7 years was associated with current asthma at 32 years of age, particularly in women.[10] However much less is known about the possible role of obesity/overweight in rhinitis.

The aims of the present analysis of data from the Swiss Cohort Study on Air Pollution and Lung and Heart Diseases in Adults (SAPALDIA) were to address the following questions:

1. Does second hand smoke (SHS) increase the risk of allergic or non-allergic rhinitis?
2. Does obesity/overweight increase the risk of allergic or non-allergic rhinitis?
3. Are any associations independent of demographic factors, family history, asthma, occupational and early life exposures?

Methods

Subjects

SAPALDIA enrolled 9651 Swiss adults aged between 18 and 60 years at baseline in 1991. Subjects in the present analysis were participants in the second SAPALDIA study conducted from 2001 to 2003, when weight was measured and blood collected for allergic and other markers. The detailed methods and characteristics of participants have been described elsewhere.[11] However briefly, an interviewer administered questionnaire similar to that used in the European Community Respiratory Health Survey (ECHRS)[12] was completed by 8047 participants from 8 communities around Switzerland (Basel, Wald, Davos, Lugano, Montana, Payerne, Aarau and Geneva) (Fig. 1). A health examination was agreed to by 6528 participants and 5973 completed the entire protocol. The study was approved by the Swiss Academy of Medical Sciences and ethics committees of all regional study sites. Written informed consent was obtained from all study participants.

Definitions

Exposure to second hand smoke (SHS) was defined as a positive response to the following question: Have you been regularly exposed to tobacco smoke in the last 12 months? This definition has been previously used in SAPALDIA.[13] Overweight was defined as $25 \leq$ Body Mass Index (BMI) < 30 kg/m^2 and obesity as BMI ≥ 30 kg/m^2.[14]

The **outcome** of rhinitis was defined as a positive response to the question: Do you have any nasal allergies including hay fever? Asthma was defined as positive responses to: Have you ever had asthma? and Was this confirmed by a doctor?

Atopy was considered an effect modifier. Blood was taken from 5841 participants and assayed for total and allergen specific IgE *in vitro*. The polyvalent Phadiatop™ assay detected allergen specific IgE ≥ 0.35 kU$_A$/L to any of 11 allergens [*Cladosporium*, *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, cat, dog, horse, birch, timothy, olive, mugwort, *Parietaria judaica*].

Allergic rhinitis was defined as a positive answer to the rhinitis question together with a positive Phadiatop™. **Non-allergic rhinitis** was defined as a positive answer to the rhinitis question, with a negative Phadiatop™.

Parental atopy was defined as a positive response to either of the following questions: Did your mother ever have eczema, skin or nasal allergy or hay fever? Did your father ever have eczema, skin or nasal allergy or hay fever?

Statistical analysis

This commenced with a cross-sectional analysis of the data on rhinitis from SAPALDIA2. Univariate associations with the extent of participation or type of rhinitis were assessed in contingency tables with χ^2 tests. Comparisons between groups were made by analysis of variance or non-parametric equivalents if distributional assumptions were not satisfied. Multinomial logistic regression models were then fitted with four outcome categories defined according to the presence or absence of rhinitis and/or atopy. Forward entry was used with stepwise selection based on the likelihood ratio test. Initial selection of covariates was guided by the literature and prior knowledge. Covariates included: demographic — age, sex, level of education, nationality (Swiss/other); family history — maternal or paternal asthma or atopy; occupation — self reported exposure to vapours, gas, dust or fumes; early childhood "hygiene" — number of older siblings, early respiratory infections, farm residence and day care attendance; and active smoking — non-smoker, ex-smoker or current smoker. Sensitivity analyses were conducted and covariates retained in the models if they altered the OR by 10%. Doctor diagnosed asthma was initially fitted as a covariate, and subsequently examined as a stratification variable. The effect estimates from the multinomial logistic models were expressed as Relative Risk Ratios (RRR) and 95% confidence intervals (95%CI), relative to the group with no rhinitis or atopy. RRR can be interpreted as odds ratios conditional on having observed either the reference outcome or the outcome in question. Analyses were conducted in SPSS (version 19, IBM, Armonk NY 2010) and SAS (version 9.3, SAS Institute Inc., Cary NC, USA, 2011).

Results

Description of subjects

Of the 8047 participants in this follow-up study, 4180 (51.9%) were female and 3867 (48.1%) male. The mean (SD) age at this examination was 52.1 (11.6) years. Mean BMI was 25.9 (4.45) kg/m^2, thus 2494 (25.8%) were classified as overweight and 1068 (11.1%) obese. The educational level of 2082 (25.9%) participants was considered high (University or technical college), 5257 (65.4%) intermediate (middle school or apprenticeship) and 702 (8.7%) low (primary and/or secondary school). Doctor diagnosed asthma was