

Prevalence of Self-reported Allergic and Non-allergic Rhinitis Symptoms in Stockholm: Relation to Age, Gender, Olfactory Sense and Smoking

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Objective—To estimate the prevalence of isolated self-reported allergic and non-allergic rhinitis symptoms in an adult population and to explore the relations to age, gender, olfaction and smoking habits.

Material and methods—Self-judged health and environmental exposures were investigated by means of a questionnaire survey administered to a stratified random sample of 15,000 adults in Stockholm County.

Results—A total of 10,670 individuals were included in the analysis, corresponding to a response rate of 73%. The results revealed a high prevalence of self-reported non-allergic rhinitis, 19%, almost as high as the prevalence of self-reported allergic rhinoconjunctivitis, 24%. In contrast to current clinical opinion, we did not find a significant increase in the prevalence of non-allergic symptoms with increased age. There were no statistically significant gender differences in the prevalence of either allergic or non-allergic symptoms. A reduced sense of smell was twice as common in the non-allergic group, 23%, as in the healthy population. The prevalence of rhinitis symptoms differed according to smoking habits.

Conclusion—Both self-reported allergic rhinitis symptoms and non-allergic nasal symptoms are frequent in the population sample. Self-reported non-allergic nasal symptoms seem to occur independent of age and reduced olfactory sense is a common complaint among these subjects. The prevalence of self-reported allergic and non-allergic nasal symptoms did not differ much between men and women or between individuals with different smoking habits. *Key words:* adults, age, allergic rhinitis symptoms, gender, non-allergic nasal symptoms, olfaction, prevalence, questionnaire survey, self-report, smoking.

INTRODUCTION

Rhinitis is an inflammation of the nasal mucosa characterized by sneezing, nasal itching, rhinorrhea and/or nasal blockage for >1 h on most days. Furthermore, in the last decade, impaired smell has been noted as an important symptom of rhinitis. Rhinitis may be either allergic, non-allergic (atrophic rhinitis, idiopathic rhinitis, etc.) or infectious. Seasonal allergic rhinitis (SAR) is frequently accompanied by conjunctivitis.

There are substantial worldwide variations in the prevalence and labeling of symptoms of allergic rhinoconjunctivitis (1–3). SAR has been studied in particular. The prevalence of SAR is said to rise rapidly above 3 years of age, peaking in early adulthood and thereafter declining with advancing age (4, 5). Childhood allergic rhinitis shows a preference for males but the sex ratio is equal in adults (4). The prevalence of allergic rhinoconjunctivitis among adults in Europe is reported to range from 10% to 30% (6–9).

There is little information concerning the prevalence of non-allergic rhinitis. A prevalence of non-allergic nasal complaints of 11–22% has been estimated from a limited number of studies, most of which featured low response rates and/or selected populations (10–13). One-third of an adult Swedish population had significant allergic and/or non-allergic nasal symptoms in a questionnaire survey performed in

1992 (14). Non-allergic rhinitis is believed to increase with age (15).

The aim of this study was to estimate the prevalence of self-reported allergic and non-allergic nasal symptoms in an adult Swedish population. We also wanted to explore relations to age, gender, olfaction and smoking habits.

MATERIAL AND METHODS

Self-judged health and environmental exposures were investigated by means of a questionnaire survey administered to a stratified random sample of 15,000 individuals, aged 19–80 years, out of a total of 1.3 million in this age group in Stockholm County. The survey was distributed in order to estimate the occurrence of environmental exposures and the prevalence of possible environment-related diseases and disturbances in general. In order to permit comparisons between different areas of the County, mainly concerning traffic- and noise-related exposures, a simple random sample was drawn from each of 17 geographical areas. The Karolinska Hospital's ethics committee reviewed the study design and judged that formal approval was not required for the study. The questionnaire handling (distribution, retrieval and digitalization) was performed by Statistics Sweden.

The questionnaire contained 87 questions on general and specific health, housing, symptoms, diet,

recreation, family, profession, income, residence and education. The questionnaire was first distributed on 26 February, 1997 and the last date for acceptance of completed questionnaires was 19 June, 1997.

A total of 14 622 individuals received the questionnaire, 10 680 of whom responded. Ten responses were excluded because of incomplete answers, which left 10 670 responses for analysis, corresponding to a response rate of 73%. The response rate was lower among persons born outside Sweden (69% among those from Nordic countries, 64% from other parts of Europe and 59% from non-European countries), males (68%) and young people (69% in the 19–29 years age group).

Regarding the question “Are you suffering from or have you had any of the following diseases?”, the individual could answer yes to any of the following responses:

1. Asthma;
2. Allergic eye symptoms;
3. Hay fever or any other allergic rhinitis;
4. Other nasal symptoms (recurrent sneezing, itching, nasal blockage, etc.); and
5. Chronic bronchitis or emphysema.

A total of 39% of the individuals answered yes to at least one of the responses, i.e. 61% gave no positive answer.

Concerning smoking habits, the individual could answer yes or no to the question “Do you smoke on a daily, or almost daily, basis?” Regarding the question “Have you previously smoked on a daily basis for at least 1 year?” the individual could answer yes or no.

Concerning olfaction the individual could answer yes/often, yes/from time to time or no/never to the question “Are you suffering from a reduced sense of smell or have you had a reduced sense of smell in the last 3 months?”

In a further analysis of age, smoking habits and olfaction, we compared self-reported allergic rhinoconjunctivitis symptoms only (unique) and self-reported non-allergic nasal symptoms only (unique) in order to try to exclude individuals with self-reported allergic rhinoconjunctivitis from those in the self-reported non-allergic nasal symptoms group.

The definitions of different types of rhinitis were made by the authors as shown in Tables I and II in order to permit analysis of the rhinitis symptom data obtained from the extensive questionnaire survey.

Prevalence figures were computed with 95% confidence intervals (CIs) using the stratified sampling procedure. All reported prevalence estimates have a standard error of < 1% point. χ^2 tests were performed to test the independence of variables and *p*-values are presented. In order to obtain the slope of the plot of

Table I. *Definitions of self-reported rhinitis symptoms made by the authors on the basis of responses to the question “Are you suffering from or have you had any of the following diseases?”. See text for details of the possible responses 1–5*

Allergic rhinitis symptoms
Yes to response 3
Allergic rhinitis symptoms, unique
Yes to response 3, but no to responses 1, 2, 4 and 5
Allergic rhinoconjunctivitis symptoms
Yes to responses 2 or 3
Allergic rhinoconjunctivitis symptoms, unique
Yes to responses 2 or 3 but no to responses 1, 4 and 5
Non-allergic nasal symptoms
Yes to response 4
Non-allergic nasal symptoms, unique
Yes to response 4 but no to responses 1, 2, 3 and 5
Healthy (61%)
No to responses 1–5

age against prevalence, a logistic regression model was fitted and predicted probabilities for self-reported rhinoconjunctivitis and self-reported non-allergic nasal symptoms as a function of age were calculated and presented graphically with 95% confidence bands. Pearson correlation coefficients were calculated for prevalence and age in 1-year classes.

RESULTS

The prevalence of self-reported allergic rhinoconjunctivitis symptoms was 24.0%, dropping to 11.9%

Table II. *Definitions made by the authors*

Allergic rhinitis: suffers from or has experienced hay fever or any other form of allergic rhinitis
Allergic rhinoconjunctivitis: suffers from or has experienced hay fever or any other form of allergic rhinitis and/or suffers from or has experienced allergic eye symptoms
Non-allergic rhinitis: suffers from or has experienced other nasal symptoms (recurrent sneezing, itching, nasal blockage, etc.)
Normal olfactory sense: no reduced olfactory sense during the last 3 months
Reduced olfactory sense/often: had reduced olfactory sense (every week) during the last 3 months
Reduced olfactory sense/from time to time: from time to time had reduced olfactory sense during the last 3 months
Current smoker (cigarettes, cigars, pipe): daily or almost daily smoking
Former smoker: formerly daily smoker for at least 1 year
Non-smoker: no daily or almost no daily smoking
Healthy: never suffered from asthma, allergic eye symptoms, allergic rhinitis symptoms, other nasal symptoms, bronchitis or emphysema

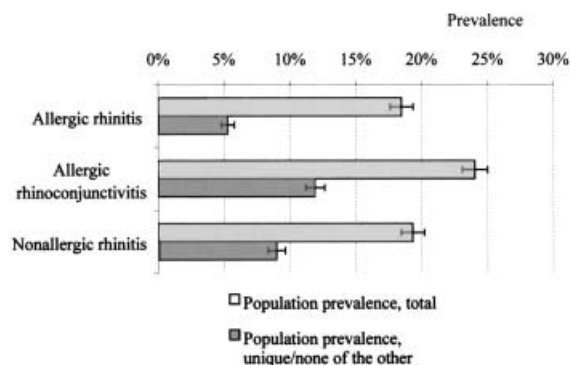


Fig. 1. Prevalence of self-reported rhinitis symptoms with 95% CIs.

(unique) when persons with self-reported non-allergic nasal and lower airway symptoms were excluded (Fig. 1).

The prevalence of self-reported allergic rhinitis symptoms was 18.5%, dropping to 5.3% (unique) when persons with self-reported non-allergic nasal symptoms, asthma, bronchitis and/or allergic eye symptoms were excluded (Fig. 1). A total of 19.3% of respondents had experienced self-reported non-allergic nasal symptoms, but this prevalence dropped to 9% (unique) when persons with self-reported allergic rhinitis, conjunctivitis and lower airway symptoms were excluded (Fig. 1).

The prevalence of unique self-reported allergic rhinoconjunctivitis symptoms decreased substantially with age. The predicted probabilities from a logistic regression model of age against unique self-reported allergic rhinoconjunctivitis symptoms are shown in Fig. 2 along with confidence bands and point estimates of prevalence in each 1-year age class. The logistic regression model was highly significant ($p < 0.001$) and

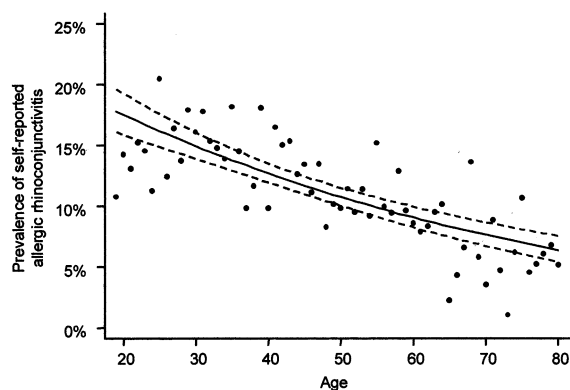


Fig. 2. Predicted probabilities and 95% confidence bands from a logistic regression model of age on self-reported allergic rhinoconjunctivitis. Dots show prevalence in 1-year classes.

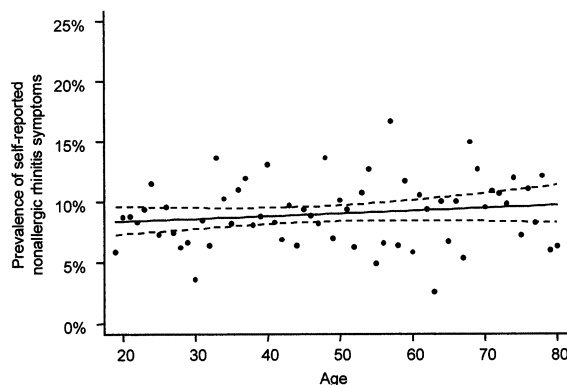


Fig. 3. Predicted probabilities and 95% confidence bands from a logistic regression model of age on self-reported non-allergic rhinitis symptoms. Dots show prevalence in 1-year classes.

the Pearson correlation coefficient of prevalence against age in 1-year classes was 0.76 (Fig. 2). In contrast, the prevalence of unique self-reported non-allergic nasal symptoms showed a slight increase with age. The corresponding logistic regression model was not statistically significant ($p = 0.259$; see Fig. 3) and the Pearson correlation coefficient was 0.14 (Fig. 3).

The prevalence of both self-reported allergic and non-allergic rhinitis symptoms differed according to smoking habits ($p = 0.003$ and 0.025 , respectively). The unique prevalence of self-reported allergic rhinoconjunctivitis symptoms differed according to smoking habits. Prevalence was highest ($p = 0.003$) among non-smokers (13.1%), lowest among former smokers (10.1%) and intermediate among current smokers (Fig. 4). The difference in the unique prevalence of self-reported non-allergic nasal symptoms was also statistically significant ($p = 0.025$) among the different smoking groups. For non-allergic nasal symptoms the lowest prevalence (8.2%) was found among non-smokers and the highest among current smokers.

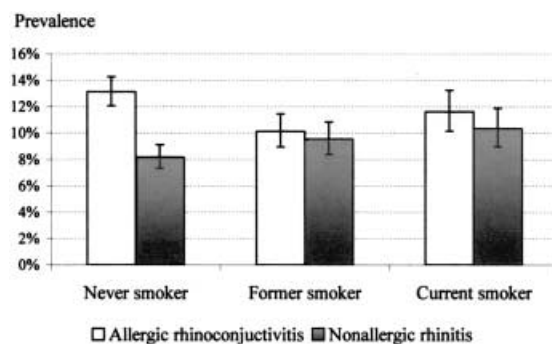


Fig. 4. Prevalence of self-reported allergic rhinoconjunctivitis and non-allergic nasal symptoms, with 95% CIs, according to smoking habits.

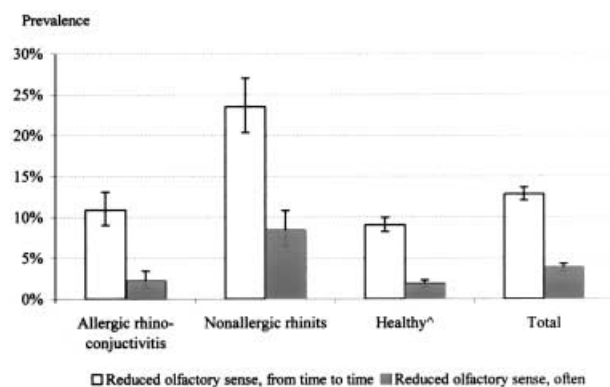


Fig. 5. Prevalence of reduced olfactory sense, with 95% CIs, among adults with self-reported allergic rhinoconjunctivitis symptoms, those with self-reported non-allergic nasal symptoms and healthy individuals (^ no asthma, allergic rhinitis, allergic conjunctivitis, non-allergic nasal symptoms or bronchitis).

The prevalence of reduced olfactory sense in the unique group of self-reported allergic rhinoconjunctivitis symptoms (10.9% from time to time and 2.2% often) was similar to that in the healthy group (9.0% and 1.9%, respectively; $p = 0.186$) (Fig. 5). In contrast, in the unique group with self-reported non-allergic nasal symptoms, the prevalence of reduced olfactory sense was 3–4 times as high as that in the healthy group (23.5% and 8.4%, respectively; $p < 0.001$) (Fig. 5).

There were no statistically significant gender differences in prevalence seen between self-reported allergic rhinoconjunctivitis and self-reported non-allergic nasal symptoms. The prevalence of self-reported allergic rhinoconjunctivitis symptoms (unique) among women was 12.2%, compared to 11.5% among men. The prevalence of self-reported non-allergic nasal symptoms (unique) among women was 8.8%, compared to 9.2% among men.

DISCUSSION

The prevalence of self-reported allergic rhinoconjunctivitis and allergic rhinitis symptoms was high, 24%, but within the expected range (5–9). The Swiss study on Air Pollution and Lung Diseases in Adults (SAPALDIA) (6), a multicenter cross-sectional study performed in 1995, estimated the prevalence of atopic rhinitis as 13.5%; the prevalence of hay fever varied between 9.1%, 11.2% and 14.2%. That study of 8357 adults, aged 18–60 years, used a standardized computer interview, skin prick tests and IgE determination. Jones et al. (7) analyzed 2114 questionnaires from individuals > 14 years of age from 1,200 randomly selected households in Nottingham, UK. They found that 19.6% of persons reported hay fever and

8.6% reported perennial nasal symptoms without hay fever. Åberg (16) studied 55,393 Swedish conscripts, using a health questionnaire and physical examination, in 1971 and 1981. He noted an increase in the prevalence of allergic rhinitis/rhinoconjunctivitis from 4.4% in 1971 to 8.4% in 1981.

The prevalence of self-reported non-allergic nasal symptoms in this study was also high, 19%, corresponding with some earlier data (10, 11, 14). In the study of Sibbald and Rink (10), involving a questionnaire, interview and skin prick test performed in London in 1986 in a sample of 2,969 adults aged between 16 and 65 years, the estimated minimum prevalence of rhinitis was 24%, with 13% perennial symptoms (50% atopic), 8% both perennial and seasonal symptoms (68% atopic) and 3% seasonal symptoms alone (78% atopic). The weakness of that study is that it was conducted on patients from a general practice and that the response rate was only 39%.

The prevalence of non-allergic nasal complaints was found to be 21% in a Swedish modified Kern's questionnaire study conducted in the 1980s in 1459 randomly selected persons, age 16–82 years; the response rate was 75% (11). In a more recent questionnaire study of nasal symptoms and their relation to self-reported asthma and chronic bronchitis performed in southern Sweden by Montnémy et al. (14), 33% of the 20–59 year age group reported significant nasal symptoms. A total of 8,469 randomly selected persons (70% response rate) answered 18 questions about lung symptoms and 8 questions on nasal symptoms specifically designed by the authors. They believed that non-allergic rhinitis was probably largely responsible for the 12% of the study population who had nasal symptoms without concomitant eye symptoms and who reported that tobacco fumes, etc. provoked their symptoms.

The main findings of our study were that reduced olfactory sense is a common complaint among subjects with self-reported non-allergic nasal symptoms and that these symptoms seem to occur independent of age. These findings are based on a questionnaire survey performed on a large sample from Stockholm County Council. We studied a random population sample, in contrast to some previous studies involving selected groups. The survey was, as mentioned, distributed in order to estimate the prevalence of possible environment-related diseases *in general*, why the risk of individuals over-reporting nasal complaints is probably lower than that in specific nasal questionnaires. The response rate was high but was lower among young males born outside Sweden. How the absence of these individuals influenced the prevalence of nasal symptoms in this study is, of course, unknown. However, from other studies we know that

the prevalence of nasal symptoms in other high-income European and North American countries is at least as high as that in Sweden (7, 9).

Our study has weaknesses apart from those that always exist with questionnaires based on self-reporting. In the questionnaire there was no information that could be used to exclude, for instance, the common cold and the septum deviation from the group of individuals who selected "Other nasal symptoms". The time aspect was only considered in questions on olfaction, which makes prevalence estimates harder. Additionally, the questionnaire was distributed in Stockholm during the season of our most common airborne pollens, such as birch and grass. Separation of perennial from seasonal allergic symptoms is thus not feasible. In order to specify the two groups of rhinitis we made them mutually exclusive. Additionally, we excluded lower airway symptoms from both groups. This report of unique prevalence allowed us to better distinguish the differences between these two groups. Another weakness is that the questionnaire is not validated. A future study involving random samples of the population will address this aspect.

The prevalence of self-reported allergic rhinoconjunctivitis symptoms was highest in young adults, declining with age. We found that the prevalence of self-reported non-allergic nasal symptoms did not vary with age, in contrast to previous reports by Jessen and Janzon (11) of a U-shaped relation and of Mygind et al. (15) of a decrease in skin test-positive subjects (201 adults with perennial rhinitis) with increasing age. The 234 individuals answering a questionnaire (75% response rate) in the Jessen and Janzon study demonstrated the lowest prevalence of non-allergic nasal complaints in middle-aged people. The clinical observation that non-allergic rhinitis is a disease of the middle aged and/or elderly could thus not be confirmed as far as self-reported symptoms are concerned. Could the clinical observation be related to an increased tendency to seek medical advice with increasing age?

Non-smokers had a higher prevalence of unique self-reported allergic rhinoconjunctivitis symptoms than former or current smokers. This may be explained by a large number of informed atopic persons avoiding tobacco. However, data from the 1950s (17) suggest that the occurrence of hay fever may be lower in smokers than non-smokers. The difference between former and current smokers remains to be explained.

Another observation was that current and former smokers had more non-allergic nasal symptoms than non-smokers. This finding is in accordance with earlier epidemiological data reported by Montn  mery et al. (14) in southern Sweden, with data regarding neurogenic inflammation induced by cigarette smoke

(18) and with clinical experience. In the questionnaire study of Montn  mery et al. (14), smokers reported slightly more (34.8%) nasal symptoms than non-smokers (31.6%).

A common clinical view is that reduced sense of smell is a problem among a number of patients with non-allergic rhinitis. There is very limited knowledge of the mechanisms of loss of smell in inflammatory diseases of the upper airways. Our data show that reduced sense of smell seems to be a widespread problem in individuals with non-allergic nasal symptoms: 23% complained of olfactory dysfunction from time to time and 8% often, 3–4 times the prevalence in the healthy population. An interpretation of this finding is that this heterogeneous group may contain individuals with nasal polyposis, which has an estimated prevalence of 1–2% in the European population according to some authors (19). In studies of IgE-mediated allergic rhinitis, one-third of the population had a reduced sense of smell (20). In contrast, we found that the prevalence of reduced sense of smell did not differ between individuals with allergic nasal symptoms and the healthy population.

In conclusion, in a random population sample from Stockholm County, the prevalence of self-reported non-allergic nasal symptoms was almost as high as that of allergic rhinoconjunctivitis symptoms. Furthermore, we could not find a significant increase in the prevalence of self-reported non-allergic nasal symptoms with age, in contrast to the current clinical impression. Reduced sense of smell in the self-reported non-allergic group was substantially more common than in the healthy population. The prevalence of self-reported allergic and non-allergic nasal symptoms did not differ much between men and women or between individuals with different smoking habits.

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REFERENCES

1. Strachan D, Sibbald B, Weiland S, et al. World-wide variations in prevalence of symptoms of allergic rhinoconjunctivitis in children: the International Study of Asthma and Allergies in Childhood (ISAAC). *Pediatr Allergy Immunol* 1997; 8: 161–76.
2. Mygind N, Dahl R. Epidemiology of allergic rhinitis. *Pediatr Allergy Immunol* 1996; 7 (Suppl 9): 57–62.
3. Sibbald B, Rink E. Labelling of rhinitis and hay fever by doctors. *Thorax* 1991; 46: 378–81.

4. Smith JM, Knowler LA. Epidemiology of asthma and allergic rhinitis. I. In a rural area. II. In a university-centred community. *Am Rev Respir Dis* 1965; 92: 16.
5. Kulig M, Bergmann R, Klettke U, Wahn V, Tacke U, Wahn U and the Multicenter Allergy Study Group. Natural course of sensitization to food and inhalant allergens during the first 6 years of life. *J Allergy Clin Immunol* 1999; 103: 1173–9.
6. Wüthrich B, Schindler C, Leuenberger P, Ackerman-Lieblich U. Prevalence of atopy and pollinosis in the adult population of Switzerland (SAPALDIA study). Swiss study on Air Pollution and Lung Diseases in Adults. *Int Arch Allergy Immunol* 1995; 106: 149–56.
7. Jones NS, Smith PA, Carney AS, Davis A. The prevalence of allergic rhinitis and nasal symptoms in Nottingham. *Clin Otolaryngol* 1998; 23: 547–54.
8. van Cauwenberge P, Bachert C, Passalacqua G, et al. Consensus statement (EAACI) on the treatment of allergic rhinitis. *Allergy* 2000; 55: 116–34.
9. No authors listed. Variations in the prevalence of respiratory symptoms, self-reported asthma attacks and use of asthma medication in the European Community Respiratory Health Survey (ECHRS). *Eur Respir J* 1996; 9: 687–95.
10. Sibbald B, Rink E. Epidemiology of seasonal and perennial rhinitis: clinical presentation and medical history. *Thorax* 1991; 46: 859–901.
11. Jessen M, Janzon L. Prevalence of non-allergic nasal complaints in an urban and rural population in Sweden. *Allergy* 1989; 44: 582–7.
12. Turkeltaub PC, Gergen PJ. The prevalence of allergic and nonallergic respiratory symptoms in the U.S. population: data from the second national health and nutrition examination survey, 1976–80 (NHANES II). *J Allergy Clin Immunol* 1988; 81: 305.
13. Malmberg H. Symptoms of chronic and allergic rhinitis and occurrence of nasal secretion granulocytes in university students, school children and infants. *Allergy* 1979; 34: 389–94.
14. Montn  mery P, Svensson C,   delroth E, et al. Prevalence of nasal symptoms and their relation to self-reported asthma and chronic bronchitis/emphysema. *Eur Respir J* 2001; 17: 569–603.
15. Mygind N, Dirksen A, Johnsen NJ, Weeke B. Perennial rhinitis: an analysis of skin testing, serum IgE, and blood and smear eosinophilia in 201 patients. *Clin Otolaryngol* 1978; 3: 189–96.
16.   berg N. Asthma and allergic rhinitis in Swedish conscripts. *Clin Exp Allergy* 1989; 19: 59–63.
17. Sibbald B, Strachan P. In: Busse WW, Holgate ST, eds. *Asthma and rhinitis*. London: Blackwell, 1995: 32–43.
18. Lundblad L, Lundberg JM. Capsaicin sensitive sensory neurons mediate the response to nasal irritation induced by the vapour phase of cigarette smoke. *Toxicology* 1984 Oct; 33 (1): 1–7.
19. Hosemann W, Gode U, Wagner W. Epidemiology, pathophysiology of nasal polyposis, and spectrum of endonasal sinus surgery. *Am J Otolaryngol* 1994; 15: 85–98.
20. Cowart BJ, Flynn-Rodden K, McGeady SJ, Lowry LD. Hyposmia in allergic rhinitis. *J Allergy Clin Immunol* 1993; 91: 747–51.

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