

Does Working in a Hazelnut Processing Factory Increase the Risk of Hazel Pollen and Nut Sensitivity?

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ABSTRACT

Background: Hazelnut has been reported to be one of the most important food allergens.

We set out to study whether exposure to hazelnut allergen by occupational contact increases hazel pollen and hazelnut sensitivity and causes workplace-related allergic symptoms in hazelnut processing factory workers.

Methods: The study group consisted of 308 employees working in a hazelnut processing factory and 138 subjects with similar age ranges formed the control group. All subjects were asked to fill in a questionnaire about allergic symptoms and then underwent skin prick tests with 9 allergens (*Betula verrucosa*, *Corylus avellana*, *Quercus robur*, *D. farinae*, *D. pteronyssinus*, Mould mix, hazelnut, peanut and walnut).

Results: There were no workplace-related symptoms in the study group. No significant difference was found in the rate of allergic and respiratory symptoms between the study and control groups. The skin prick tests showed that birch (*Betula verrucosa*) and hazel (*Corylus avellana*) pollen sensitivities were higher in the study group than in the control group ($p < 0.01$ and $p = 0.021$, respectively). All the other skin prick test results were similar among the two groups.

Conclusions: This study showed that occupational exposure to hazelnut caused skin sensitivity to hazel and birch pollen, but this was not associated with an enhanced risk for allergic diseases.

KEY WORDS

asthma, birch, *corylus avellana*, hazel pollen, hazelnut sensitivity

INTRODUCTION

Nuts and tree nuts are among the main foods which frequently cause allergy.¹ In this group, hazelnut has often been implicated as causing allergic reactions. The major allergen of hazelnut has been identified as a pathogenesis-related protein of about 17 kD that is homologous to the major allergen of birch. It has been demonstrated that the major IgE-binding protein of hazelnut is similar to the major allergens from hazel pollen, Cor a 1, and birch pollen, Bet v 1.²

Although ingestion is the principal route for food allergens, it has been shown that severe allergic reactions could occur from exposure to minute quantities of allergen by skin contact or inhalation.³ Some studies have called attention to the possibilities of reaction to peanut or tree nut by skin contact or inhalation

as well as by ingestion.⁴⁻⁶

The aim of this study was to investigate whether exposure to hazelnut allergen by occupational contact causes hazel pollen and hazelnut sensitivity and workplace-related allergic symptoms in hazelnut processing factory workers.

METHODS

Study design : This study was planned as a cross-sectional study.

Materials : The middle and east part of the Black Sea region are the main hazelnut growing areas of Turkey. Trabzon, which is the biggest city of the eastern Black Sea region, has many hazelnut processing factories. The employees of three big factories in Trabzon were asked to participate in the study ; 308 of them accepted to be involved. All of them had been

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Table 1 Features of the study and control groups and comparison of some parameters.

Parameters	Study group N, %	Control group N, %	Significance <i>p</i> *
N	308	138	
Gender	F	F	
Age (mean)	23.4 ± 7.5	22.8 ± 5.5	NS
Duration of work (years)	2.5 ± 2.2		
Smoking by parent (s)	210 (68.2%)	86 (62.3%)	NS
Current smoking	56 (18.2%)	16 (11.6%)	NS
Hazelnut eating (regularly)	224 (72.7%)	96 (69.5%)	NS
Familial asthma	34 (11.0%)	27 (19.6%)	0.025
Nasal and conjunctival symptoms	58 (18.8%)	34 (24.6%)	NS
Cough, wheezing and dyspnea	24 (7.8%)	10 (7.2%)	NS
Reactivity to irritants	103 (33.4%)	46 (33.3%)	NS
Colds that go to the chest	68 (22.1%)	27 (19.6%)	NS
Asthma diagnosis	8 (2.6%)	2 (1.4%)	NS
Skin test positivities:			
<i>Dermatophagoides farinae</i>	13 (4.2%)	5 (3.6%)	NS
<i>Dermatophagoides pteronyssinus</i>	28 (9.1%)	7 (5.1%)	NS
<i>Betula verrucosa</i>	19 (6.2%)	1 (0.7%)	<0.01
<i>Quercus rubor</i>	6 (1.9%)	0	NS
<i>Mould mix</i>	5 (1.6%)	0	NS
<i>Corylus avellana</i>	11 (3.6%)	0	0.021
Hazelnut	9 (2.9%)	2 (1.4%)	NS
Peanut	6 (1.9%)	0	NS
Walnut	8 (2.6%)	0	NS

**p* values equal to or less than 0.05 were considered to indicate statistically significant differences.

living since birth in the vicinity of, or in nearby villages surrounded by, hazelnut fields. As the control group, 138 inhabitants of the same area who had never worked in a hazelnut factory were recruited.

Factory properties and exposure to hazelnut : In the factories, hazelnuts are shelled mechanically, and then pass over moving lines in front of the employees who watch and select destroyed or rotten ones, and automatically loaded into sacks. Some parts of the shelled nuts are roasted and then undergo the above procedure. The mean amount of processed nuts is about 8,500 tons/year.

QUESTIONNAIRE

The 308 employees of hazelnut processing factories and control subjects were asked to fill in a questionnaire about allergic and pulmonary symptoms as well as a family history of asthma, tobacco use, hazelnut eating habits, the duration of working in that workplace and living conditions. Those who had smoked for at least three months were described as "current smokers". Listed allergic symptoms in the questionnaire were : sneezing, nasal blockage, nasal and conjunctival itching, nasal and conjunctival discharge. (Existence of one or more of these symptoms is described as 'nasal and conjunctival symptoms' in Table 1) . Symptoms such as cough, dyspnea (short-

ness of breath at rest or during exercise), wheezing, reactivity to irritants (feeling of irritation in the throat or shortness of breath when one is exposed to some inhalants such as sprays, exhaust fumes, cigarette smoke etc.) and frequent "colds that go to the chest" are listed as respiratory symptoms in the questionnaire. The study and control subjects were asked to mark 'yes' if they had had one or more of these symptoms or asthma diagnosis in the last 6 months and to specify if their symptoms were work-related.

SKIN PRICK TESTS

Skin prick tests with 9 allergens (*Betula verrucosa*, *Corylus avellana*, *Quercus robur*, *D. farinae*, *D. pteronyssinus*, *Mould mix*, hazelnut, peanut and walnut), histamine hydrochloride (10 mg/ml) and glycerol diluents as controls were performed in all subjects according to the recommendations of the manufacturer (ALK-Abello®, Denmark). The grading system based on the relation between the reaction induced by allergen and histamine reference was used. Reactions equal to or greater than that caused by histamine were graded 4+ while responses of = 3 mm wheals in diameter were graded 1+. Reactions between these limits were graded 2+ or 3+.

Table 2 Risk estimates of some parameters in the study group and control group.

Risk factors	Study Group			
	Nasal Symptoms	Cough	Dyspnea	Asthma Diagnosis
Familial asthma	OR 2.3 (%95 CI 1,4-6,6)	OR 6.1 (%95 CI 3,2-20,8)	OR 10.6 (%95 CI 2,5-55,7)	OR 10.62 (%95 CI 2,5-55,7)
Smoking	NS	NS	NS	NS
	Control Group			
	Nasal symptoms	Reactivity to irritants	Colds that go to the chest	Asthma diagnosis
Familial asthma	OR 4.9 (%95 CI 1.9-12.03)	OR 4.8 (%95 CI 1.9-111.8)	OR 2.5 (%95 CI 1.04-6.6)	NS
Smoking	NS	NS	NS	NS

STATISTICAL ANALYSIS

Statistical analysis was performed using SPSS 9.05. The various parameters of the two groups were compared using the chi-square test. The risk factors for allergic and asthmatic symptoms were analyzed with logistic regression analyses.

RESULTS

The characteristics of the study group and control group are shown in Table 1.

ALLERGIC SYMPTOMS

Reported allergic symptoms including those of rhinitis and conjunctivitis were not significantly different between the two groups (Table 1). Symptoms in the study group were not related with the workplace.

RESPIRATORY SYMPTOMS

Respiratory symptoms such as cough, dyspnea, reactivity to irritants and "colds that go to the chest" were similar in both groups, except for family history of asthma which were more common in the control group ($p = 0.025$).

SKIN PRICK TESTS

The skin prick tests showed that birch (*Betula verrucosa*) and hazel (*Corylus avellana*) pollen sensitivities were higher in the study group than in the control group ($p < 0.01$ and $p = 0.021$ respectively). All the other skin prick test results were similar among the two groups.

REGRESSION ANALYSES

These analyses were performed separately in both groups.

Study group : 1. The risk of rhinitis, cough, dyspnea and having a diagnosis of asthma increased at various rates in subjects with a family history of asthma (Table 2). Smoking, either familial or individual, was not a relevant risk factor for allergic or respiratory symptoms.

2. House dust mite (*Dermatofagoides*) sensitivity was found to be correlated with rhinitis symptoms but not with other symptoms. Hazel pollen and birch

pollen skin test positivity were strongly correlated with each other, while oak (*Quercus*) pollen sensitivity was correlated with only hazel pollen sensitivity.

Control group : The risks of rhinitis, bronchial reactivity and "colds that go to the chest" were increased several fold in those with a familial history of asthma. Cigarette smoking, either individual or familial, did not affect the risk of allergic or respiratory symptoms.

DISCUSSION

In a study sponsored by The Food Allergy and Anaphylaxis Network (FAAN) in the US, tree nut allergy was shown to exist in 0.2% of children and 0.7% of adults.⁶ According to this study, walnut was the most frequently reported nut causing allergic symptoms. As for Europe, hazelnut was demonstrated as the most common cause of IgE-mediated food allergy in Switzerland.⁷ The current prevalence of tree nut allergy in Turkey is not well known yet, despite the fact that our country is the most important source of hazelnut production and one of the major sources of pistachio production in the world.⁷ Some western parts and most eastern parts of the Black Sea region have large fields of hazelnut trees. Pistachio nut has been mainly produced in the south-eastern region of Turkey.

In our study none of the participants, all of whom have lived in a hazelnut growing area since birth, described nut allergy. Although food allergy has been recently proposed to have geographical properties,⁷ in the above mentioned parts of our country, the very high density of hazel trees in the environment and the close contact of people with hazel do not seem to form a significant risk for nut allergy as demonstrated by the lack of reported cases. The question of whether a tolerance to hazelnut could be a possible explanation of this result needs to be clarified.

Another important matter is whether the increased skin sensitivity to birch and hazel pollen in the study group could be explained by inhalation of hazel allergens in the workplace.

In the study of Hirschwehr *et al.*, a molecular basis was provided for the observed clinical phenomenon

that food and pollen allergies are frequently associated.² In that study, the authors suggested that a protein with IgE binding properties similar to the major allergens from hazel pollen, Cor a 1, and birch pollen, Bet v 1, exists as the predominant allergen in hazelnuts and showed that the plant pan-allergen profilin could be detected in both hazel and hazelnut extracts. On the other hand, severe allergic reactions to hazelnuts are reported in patients without any association to tree pollen allergy.⁸ Recently Beyer *et al.* identified a new 11S globulin named Cor a 9 as another hazelnut food allergen and proposed that it might be the major allergen for some allergic patients.⁹ In our study, a high degree of positive correlation was found between birch and hazel pollen sensitivities in the hazelnut workers, although hazelnut skin sensitivity was not correlated with them. Several speculations might be made to explain this finding : Firstly, sensitivity of skin testing with food allergens is generally accepted to be lower than that with other allergens such as pollen or house dust mites, because they are not fully standardized and identified. Secondly, the habitants of that area frequently use hazelnut instead of any other nut in their cakes, pies or cookies and might thus have become tolerant. Finally, hazelnut allergens other than cross-reactive ones with hazel pollen allergens might play a role in that discrepancy.

The results of skin testing were not correlated with the allergic and respiratory symptoms of which the prevalence was of important levels in both the study group and the control group. Moreover, these symptoms were found to correlate well with the familial history of asthma of which the rate was 11% in the study group and 19.6% in the control group. In a previous large study,¹⁰ in the north-east of Turkey (Black Sea region) where the current study was done, the asthma prevalence had been found to be higher than the mean prevalence of the other regions, which might be explained by the effect of the very humid climate of the region or by genetic factors.

In conclusion, occupational exposure to hazelnut seems to enhance skin sensitivity to hazel and birch

pollens, although it does not seem to affect the risk of allergic and asthmatic symptoms, or rate of hazelnut allergy.

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