SHORT REPORT

Asymptomatic sensitisation to grapes in a sample of workers in the wine industry

D Kalogeromitros, D Rigopoulos, S Gregoriou, V Mousatou, N Lyris, D Papaioannou, A Katsarou-Katsari

Occup Environ Med 2004;61:709–711. doi: 10.1136/oem.2003.012427

Aims: To assess the prevalence of sensitisation to grapes (*Vitis vinifera* var. *agiorghitiko*) in a population with repeated exposure to grape allergens through direct cutaneous contact as well as through the gastrointestinal tract.

Methods: One hundred and twenty subjects were enrolled in each of four groups: grape harvesters, winery workers in selection of grapes, winery workers operating de-stemming/crushing/pressing machines, and administrative personnel. Sensitisation to grapes was examined by skin prick-to-prick tests with fresh fruit and juice.

Results: Eight harvesters and five workers in grape selection had positive reaction to the grapes tested. No machine operators or administrative personnel had positive tests. The likelihood of sensitisation was estimated at 3.7% per year of occupation by logistic regression analysis. None of the employees reported symptoms associated with sensitisation to grapes.

Conclusion: Asymptomatic sensitisation to grapes was detected only in workers handling the fruit, suggesting that sensitisation is more likely to occur through cutaneous exposure and/or minor wounding than through the gastrointestinal tract. Prevalence rates were high and the clinical impact needs to be further investigated.

Grapes (*Vitis vinifera*, *Vitis labrusca*) are extensively cultivated plants in temperate regions for consumption and the production of wine. Despite widespread consumption since prehistorical times, as suggested by the popular worship of deities such as Dionysus and Bacchus and consequent exposure of a large part of the general population to grape allergens, allergy to grapes is relatively rare. Allergic reactions to grapes reported in the literature are limited and described mainly as case reports.^{1–2} A recent study identified endochitinase 4, a lipid transfer protein and a thaumatin as the grape allergens in *V. vinifera* and *V. labrusca* species,³ but whether these allergens are the only ones in all lesser/hybrid grape species has not been properly investigated. The prevalence of sensitisation to grape species and varieties is still undetermined.

Repeated exposure to an allergen increases the chance of sensitisation. This fact has been confirmed by numerous studies reporting increased sensitisation after long term exposure, including increased sensitisation to hymenoptera venom in beekeepers,⁴ to latex in hospital personnel,⁵ and to laboratory animals' allergens in laboratory workers.⁶ The aim of this study was to assess the prevalence of sensitisation to grapes, in a population with repeated exposure to grape allergens through direct cutaneous contact as well as through the gastrointestinal tract.

SUBJECTS AND METHODS

Subjects worked at the vineyards and "K Boutaris" winery of Nemea, a red wine producing area of North Peloponnisos in Greece. Grapes cultivated in the Nemea region are of the *Vitis vinifera* species, *agiorghitico* variety that is native to the region.

One hundred and twenty subjects were enrolled in each of three groups—harvesters (group A), workers in grape selection (group B), and workers operating de-stemming/crushing/pressing machines (group C) after consent was obtained from the vineyard owners and the management of the winery. One hundred and twenty healthy office employees in the region were included in the study as controls (group D). There were no refusals and informed written consent was obtained from all individuals selected. Harvesters worked in the vineyards for 10 hours daily for 20–30 days each year, gathering the fruits in containers with bare hands. Workers in selection of grapes sorted out with bare hands different quality grapes passing in front of them on conveyor belts. Participants in the grape selection worker group were all women. Workers operating the de-stemming/crushing/pressing machines did not come in direct contact with grapes or their products, but inhaled de-juiced must vapours for eight hours daily. All administrative personnel in the control group worked in different buildings and had no contact with grapes or grape products. Most of the subjects consumed grapes regularly during working hours (particularly in groups A and B) and at home.

All workers completed a short questionnaire regarding their sociodemographic characteristics as well as history and family history of atopic diseases diagnosed by a doctor (asthma, rhinitis, urticaria, food and drug allergy, and atopic dermatitis). Reported symptoms of oral allergy syndrome, contact urticaria, or anaphylaxis after grape consumption were also recorded. Cumulative duration of occupation was estimated, as working in vineyard harvesting-winery jobs is a one month per year seasonal occupation.

Skin prick-to-prick tests were performed on all employees with grapes and grape juice in the following manner: a single use standard prick needle was inserted into the grape and then immediately into the skin.⁷ Prick-to-prick tests with fresh fruit are considered to be more reliable in diagnosis of grape sensitisation compared to the commercial skin tests, particularly if a specific species is to be investigated.⁸ Grapes were tested after their surface was cleaned with absolute ethanol to rule out possible fungal contamination. A positive skin reaction was defined as the presence of a wheal equal to or greater than the one elicited by a histamine hydrochloride (10 mg/ml) control after 20 minutes. Normal saline was used as negative control. Results were recorded in transparent tape and erythema and wheal surface was estimated through the use of a planimeter. None of the subjects reported intake of any drugs that interfere with skin reactivity (antihistamines, sedatives, etc). Recent studies have shown a possible relation between allergic reactions to grapes and other fruits.²

Main messages

- Workers handling grapes are more likely than those inhaling must vapours or controls to present sensitisation.
- The likelihood of sensitisation to grapes is estimated to 3.7% per year of exposure.

Policy implications

- Sensitisation to grapes is high in workers in the wine industry. Although sensitisation in this initial study was found to be asymptomatic, the lack of comparative data calls for further investigation to confirm the results and assess clinical impact.

Sensitisation to apple, peach, cherry, and banana was also investigated using prick-to-prick tests. Investigation of atopy using skin prick tests with 10 commercial allergens was not possible on all employees due to the production schedule of the winery. Blood samples were not drawn from the workers for radioallergosorbent test (RAST) and total IgE measurement for the same reasons.

Odds ratios and 95% confidence intervals were calculated only between groups presenting positive skin tests. A classical model of logistic regression analysis (forward stepwise) was applied to explore the association between grape sensitisation and the following variables: age (in years), sex (male = 0, female = 1), personal history of atopic diseases (no = 0, yes = 1), family history of atopic diseases (no = 0, yes = 1), and total time interval in workplace (in months). The Statistical Package for the Social Sciences (SPSS) was used for the statistical analysis.

RESULTS

Table 1 presents demographic data for the employees. None of the participants reported symptoms of anaphylaxis, contact urticaria, or oral allergy syndrome to grapes.

Eight workers in group A (6.7%) and five (4.2%) in group B presented positive prick-to-prick tests to grapes. Differentiation in sensitisation in the two groups is not significant as shown by the calculated odds ratio of 1.64 (95% CI 0.52 to 5.17). None of the workers in groups C or D presented positive tests (table 1). One should point out that 15 more people in group A and nine in group B had weak positive prick-to-prick tests but with a wheal smaller than

histamine, and were considered as negative for the purposes of this study.

Few employees had positive prick-to-prick tests to fruits that appear to present cross-reactivity to grapes. None of the subjects presented reactivity to peach, one reacted to banana, three to apple (all with negative prick-to-prick to grapes), and 12 to cherry (seven with negative and five with positive prick-to-prick tests to grapes). None of the workers in groups C or D presented positive tests to these fruits. Although we did not perform RAST inhibition tests, the distribution of sensitised workers to these fruits in association with their reactivity to grapes suggests that grape sensitisation in the groups under study is not likely to be the result of cross-reaction.

Results of logistic regression analysis performed on employees of groups A and B in order to investigate the possible association of certain variables on sensitisation to grapes indicate that only the duration of occupational exposure can be considered a determinant. For each year of occupation in harvest or winery jobs the risk of sensitisation to grapes increases by 3.7% (table 1).

DISCUSSION

In this study we set out to investigate the prevalence of sensitisation to *Vitis vinifera* in a population with increased exposure through direct cutaneous contact as well as through the gastrointestinal tract. Results indicate that in subgroups A and B, where the exposure was greater, the prevalence of sensitisation was 6.7% and 4.2% respectively. Since there are no relevant studies on grapes, comparative analysis is not

Table 1 Demographics and results of prick-to-prick tests and logistic regression analysis

	Group			
	A (grape harvesters)	B (workers in grape selection)	C (workers in grape de-stemming/crushing/pressing machines)	D (controls)
Age, mean (SE)	39.9 (1.4)	39.8 (1.3)	34.8 (1.2)	41.0 (1.4)
Sex, F/M	49/71	120/0	45/75	61/59
Positive history of allergy (%)	29/120 (24.2%)	35/120 (29.2%)	38/120 (31.7%)	28/120 (23.3%)
Positive family history of allergy (%)	32/120 26.7%	20/120 16.7%	32/120 26.7%	25/120 20.8%
Duration of occupational exposure (mth), mean (SE)	170 (15.9)	89.7 (7.6)	89.3 (9.4)	139.4 (14.7)
Positive SPT to grapes (%)	8 (6.7%)	5 (4.2%)	0	0
Logistic regression analysis: dependent variable SPT to grapes (1 = yes, 0 = no) (only groups A and B were included)				
Variable	Odds ratio		95% CI	
Sex	0.917		0.197–4.262	
Age	0.976		0.920–1.035	
Personal history of atopic diseases	1.051		0.267–4.132	
Family history of atopic diseases	1.150		0.278–4.752	
Duration of occupational exposure	1.003		1.001–1.006	
Group	0.962		0.193–4.799	

possible. Prevalence of sensitisation to other products in workers in respective manufacturing industries indicates similar results. Sensitisation to enzymes in the animal feed industry has been estimated to be 7%.⁹ Sensitisation to latex, a high potency allergen, in tappers and glove factory manufacture workers has been reported to range between 1.3% and 11% in four studies.¹⁰

The reported sensitisation to grapes in the population studied is asymptomatic since none of the employees reported history of symptoms associated with anaphylaxis, contact urticaria, or oral allergy syndrome after grape consumption. Although the hypothesis that workers sensitised with work related symptoms might have been forced to leave the exposure cannot be ruled out, the fact that none of the workers under study was symptomatic suggests that this possibility is remote. The clinical impact of sensitisation cannot be assessed without further investigation. We informed in writing all sensitised individuals and counselled them in case of symptom presentation. We intend to repeat testing after three years.

Sensitisation to grapes was detected only in workers handling the fruit, suggesting that sensitisation is more likely to occur through cutaneous exposure and/or minor wounding than through the gastrointestinal tract. Results of the logistic regression analysis tend to confirm this hypothesis, since the only variable increasing the likelihood of sensitisation is increased duration of occupational exposure. This likelihood has been estimated to be 3.7% for each year of occupation. Unfortunately it was not possible to investigate atopy predisposition by prick tests in all workers. However, no association between history and family history of atopic diseases and sensitisation to grapes was established with the logistic regression analysis.

This is the first study attempting to estimate the prevalence of sensitisation to grapes in grape harvesters and workers in wineries. Further investigations should be undertaken to confirm the results and provide more data on this issue.

ACKNOWLEDGEMENTS

We thank all workers in Nemea vineyards and the "K Boutaris" winery who participated in this study, and the "K Boutaris" company for financial support.

Authors' affiliations

D Kalogeromitros, D Rigopoulos, S Gregoriou, V Mousatou, N Lyris, D Papaioannou, A Katsarou-Katsari, Department of Allergy, University of Athens, "Andreas Sygros Hospital", Athens, Greece

Correspondence to: Prof. D Kalogeromitros, Ass. Professor of Allergy, Allergy Department, "Andreas Syngros Hospital", 5 Ionos Dragoumi str, 16121, Athens Greece; stamgreg@yahoo.gr

Accepted 24 March 2004

REFERENCES

- 1 Bircher AJ, Bigliardi P, Yilmaz B. Anaphylaxis resulting from selective sensitization to American grapes. *J Allergy Clin Immunol* 1999;**104**:1111–13.
- 2 Giannoccaro F, Munno G, Riva G, et al. Oral allergy syndrome to grapes. *Allergy* 1998;**53**:451–2.
- 3 Pastorello EA, Farioli L, Pravettoni V, et al. Identification of grape and wine allergens as an endochitinase 4, a lipid-transfer protein and a thaumatin. *J Allergy Clin Immunol* 2003;**111**:350–9.
- 4 Annala IT, Karjalainen ES, Morsky P, et al. Clinical symptoms and immunologic reactivity to bee and wasp stings in beekeepers. *Allergy* 1995;**50**:568–74.
- 5 Nolte H, Babakhin A, Babanin A, et al. Prevalence of skin test reactions to natural rubber latex in hospital personnel in Russia and Eastern Europe. *Ann Allergy Asthma Immunol* 2002;**89**:452–6.
- 6 Nieuwenhuijsen MJ, Putcha V, Gordon S, et al. Exposure-response relations among laboratory animal workers exposed to rats. *Occup Environ Med* 2003;**60**:104–8.
- 7 Dreborg S, editor. Skin tests used in type I allergy testing (position paper). *Allergy* 1989;**44**:44–51.
- 8 Caietta MF, Tarsi A, Macchia L. Grape anaphylaxis. *J Invest Allergol Clin Immunol* 2003;**13**:211–12.
- 9 Vanhanen M, Tuomi T, Tikkainen O, et al. Sensitization to enzymes in the animal feed industry. *Occup Environ Med* 2001;**58**:119–23.
- 10 Chaiear N, Sadhra S, Jones M, et al. Sensitization to natural rubber latex: an epidemiological study of workers exposed during tapping and glove manufacture in Thailand. *Occup Environ Med* 2001;**58**:386–91.