

Inhalant allergy to fresh asparagus

P. A. ENG, L. YMAN*, E. MAANINEN* and B. WÜTHRICH

Allergy Unit, Department of Dermatology, University Hospital, Zürich, Switzerland and *Pharmacia Diagnostic, Uppsala, Sweden

Summary

Background Two patients experienced itching conjunctivitis, running nose, tightness of the throat and coughing during preparation of fresh asparagus. Eating asparagus after cooking did not provoke any allergic symptoms. Both patients were atopic, sensitized additionally to pollens of grasses and trees as well as to onion.

Objective To assess the hypersensitivity reactions to fresh and heated asparagus and to investigate any crossreactivities among the allergens.

Methods Skin-prick tests were performed with commercial allergens and native asparagus and the patients were tested with Pharmacia CAP system for specific IgE antibodies against asparagus, onion, garlic, birch pollen, mugwort pollen and two recombinant birch pollen allergens, *Bet v* I and profilin. Inhibition of IgE antibody binding to solid phase homologous and unrelated allergens by increasing doses of liquid allergens (inhibitors) was studied.

Results Skin-prick tests with native green and white asparagus were strongly positive, but negative with cooked asparagus. Both patients had measurable levels of IgE antibodies against asparagus (3.0 and 6.2 kU/L respectively) and several other allergens. One patient was highly sensitive to birch and *Bet v* I. Both were positive to profilin, mugwort and onion. In all cases the antibody uptake could be extensively and specifically inhibited by homologous allergen. The asparagus-specific IgE antibodies of the two patients could only be inhibited by asparagus. No inhibition was obtained after heating of the asparagus extract to 100°C.

Conclusions The patients were specifically sensitized by asparagus. No immunological crossreactions could be observed. The measurements of IgE antibodies to other allergens were also specific, representing parallel multiple sensitivity. Profilin inhibited profilin-specific IgE binding but did not react with the asparagus-specific IgE antibodies of these patients. The asparagus allergen recognized by the specific IgE antibodies of these patients was thermolabile.

Keywords: fresh asparagus, inhalant allergy, IgE antibodies, RAST inhibition, profilin

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Introduction

Asparagus (*Asparagus officinalis*), a member of the *Liliaceae* family, is cultivated worldwide as a vegetable. There are different species with either white or green germs, depending on their chlorophyll content. Due to their

diuretic effect, asparagus was widely used in medicine until the 19th Century.

There have been several reports describing contact dermatitis as a delayed hypersensitivity reaction, which usually presents as occupational hand eczema in grocers, food handlers and workers in canneries dealing with asparagus [1,2]. To our knowledge, IgE-mediated inhalant allergies to asparagus, however, are not reported. We present two cases of inhalant hypersensitivity reactions to both fresh white and green asparagus, documented by

Correspondence: Professor B. Wüthrich, Allergy Unit, Department of Dermatology, University Hospital, Gloriastrasse 31, CH-8091 Zürich, Switzerland.

positive immediate reactions in skin-prick testing and evidence of increased specific IgE antibodies to asparagus. Potential allergenic crossreactivities with related food of the order *Liliflorae* and with pollens (birch and mugwort), frequently involved in unexpected multiple sensitivities, were investigated.

Materials and methods

Skin testing

Our usual range of commercial aeroallergen and food extracts (Alyostal, Stallergènes Laboratories, France) was used to perform skin-prick tests (SPT) with a standardized prick test needle (Stallerpoint). The asparagus prick-to-prick tests were done using native material of both raw and cooked green and white asparagus. Reactions were considered positive if a weal diameter of at least 3 mm greater than that produced by the negative control (glycerol diluent) occurred. To eliminate the possibility of a non-specific irritative reaction, three patients without histories of asparagus allergy were additionally tested in the same procedure. No reactions were observed in the control patients.

IgE antibody measurement

Allergen specific IgE antibodies in serum were measured with Pharmacia CAP (ImmunoCAP FEIA system, a fluoro-enzyme-immunoassay) according to the directions for use (Pharmacia Diagnostics AB, Uppsala, Sweden). The solid-phase allergens (birch pollen t3, mugwort pollen w6, garlic f47, onion f48, and asparagus Rf261) were commercial ImmunoCAP reagents for diagnostic or research use. *Bet v* I and profilin (*Bet v* II) ImmunoCAPs were experimental prototypes [3] prepared from recombinant allergens kindly supplied by R. Valenta and M. Susani [4,5].

IgE antibody inhibition

Inhibition of IgE antibody binding to solid-phase allergens by increasing doses of liquid allergens (inhibitors)

Table 1. Allergen preparations: maximal concentrations used in Pharmacia CAP System RAST inhibition

Asparagus	1/10 w/v
Birch pollen	1/100 w/v
<i>Bet v</i> I	75 µg/mL
Profilin	50 µg/mL
Mugwort pollen	1/100 w/v
Onion	1/10 w/v

was studied as follows. Patient serum (20 µL) and serially diluted allergen preparations (30 µL) or buffer diluent were preincubated for 3 h at 23°C. The mixtures were entered as samples in the IgE antibody assay (Pharmacia CAP System) described above and the signal (Fluorescence Units FU) at the different dilution recorded. The relative response ($FU_{\text{inhibitor}}/FU_{\text{diluent}}$) was calculated and plotted vs inhibitor concentration. Maximal inhibitor concentrations are listed in Table 1.

Asparagus extract was tested fresh and after heating to 100°C in boiling water. The allergen preparations were tested for: ability to inhibit IgE antibody binding to homologous allergen ImmunoCAP (Patient 1 and 2), lack of inhibition of IgE antibody binding to an unrelated allergen (cat specific IgE antibodies to cat allergen ImmunoCAP); and ability to inhibit asparagus-specific IgE antibody binding to Asparagus ImmunoCAP.

Case reports

Case 1

A 51-year-old woman was referred to our allergy-unit because of itching conjunctivitis and oedema of both eyelids as well as coughing, tightness in the throat and hoarseness during preparation of fresh green asparagus in Spring '93. There was no evidence of hand eczema or other cutaneous symptoms. Interestingly, no further symptoms developed when the asparagus was eaten after being cooked. The patient told about the same experiences during preparations of raw white asparagus recently before. There was no history of established asthma or clinical evidence of hay fever.

Case 2

A 55-year-old woman experiencing hay fever from February to July since the age of 17 noted for the first time in '91 itching and running nose and eyes during preparation of white as well as green asparagus. Over several occasions, she noticed these symptoms became stronger. In May 1993, she had a severe asthmatic attack, 2 months later acute dyspnoea, coughing and sneezing again during preparation of asparagus. The patient didn't experience any asthmatic symptoms before and never had any problems after eating these vegetables in restaurants or at home.

Results

Skin tests

Case 1: the SPT for environmental allergens revealed a sensitivity to pollens of grasses, rye and mugwort. Skin-prick

tests with native raw green and white asparagus were strongly positive, but negative with cooked asparagus.

Case 2: SPT demonstrated an immediate hypersensitivity to pollens of grasses, rye, birch, alder, ash and hazel. Skin-prick testing with native raw asparagus revealed a strongly positive cutaneous reaction, whereas no cutaneous reactions occurred in the same tests with cooked white and green asparagus.

IgE and IgE antibody

The results of total IgE and specific IgE antibody measurements are listed in Table 2 together with the skin test data.

IgE antibody inhibition

Asparagus allergen and five other allergen preparations — onion, mugwort pollen, birch pollen, *Bet v I* and

Table 2. Results of the basic allergological examinations of the two patients

	Patient 1	Patient 2
<i>Prick-to-prick tests with native vegetable</i>		
Green asparagus raw	++	++
Green asparagus cooked	neg	neg
White asparagus raw	++	++
White asparagus cooked	neg	neg
<i>Skin-prick tests with commercial extracts</i>		
Grass-mix	++	++
Rye	++	+
Mugwort	++	neg
Birch	neg	+++
Alder	neg	+
Hazel	neg	++
<i>Dermatophagoides pteronyssinus</i>	neg	neg
<i>Dermatophagoides farinae</i>	neg	neg
Cat dander	neg	neg
Total IgE U/L	145	150
<i>Immuno CAP kU/L (0–0.34)</i>		
Asparagus	6.2	2.97
Onion	0.52	1.63
Garlic	<0.35	0.40
Birch	0.97	26.2
Profilin	1.49	5.69
<i>Bet v I</i>	<0.35	33.0
Mugwort	1.15	2.95

Total IgE. U/L. Specific IgE. kU_A/L. Weal diameter: + ≥3 mm. ++ ≥5 mm. +++ ≥10 mm. neg. Negative.

profilin (*Bet v II*) — were shown to inhibit IgE antibody binding to the homologous solid phase allergen, but not to cat allergen (Fig. 1). Binding of Asparagus-specific IgE antibodies to solid-phase Asparagus allergen could

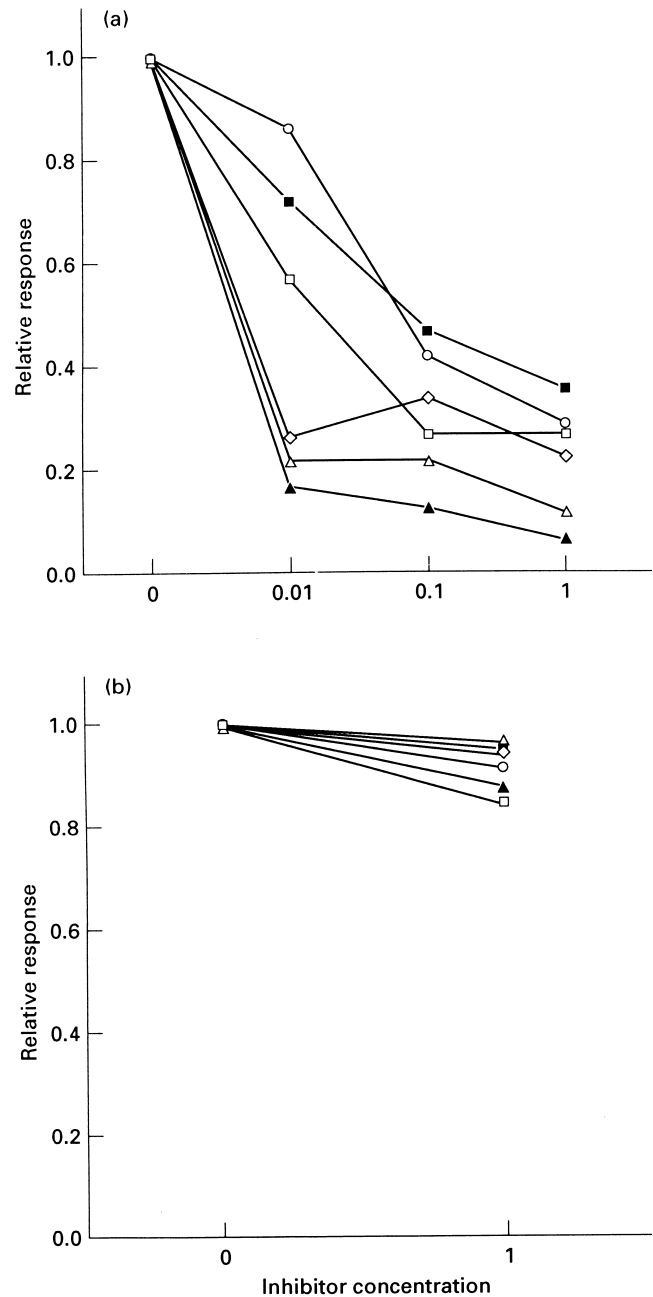


Fig. 1. Homologous inhibitory capacity and freedom from non-specific interaction (Pharmacia CAP System) shown by the allergen preparation used from the asparagus crossreactivity study. The data reported were obtained with serum of patient 2 (a) and a serum (27623) (b) with known content of cat-specific IgE antibodies. Inhibitor concentration '0' denotes diluent, and '1' the undiluted preparation according to Table 1.

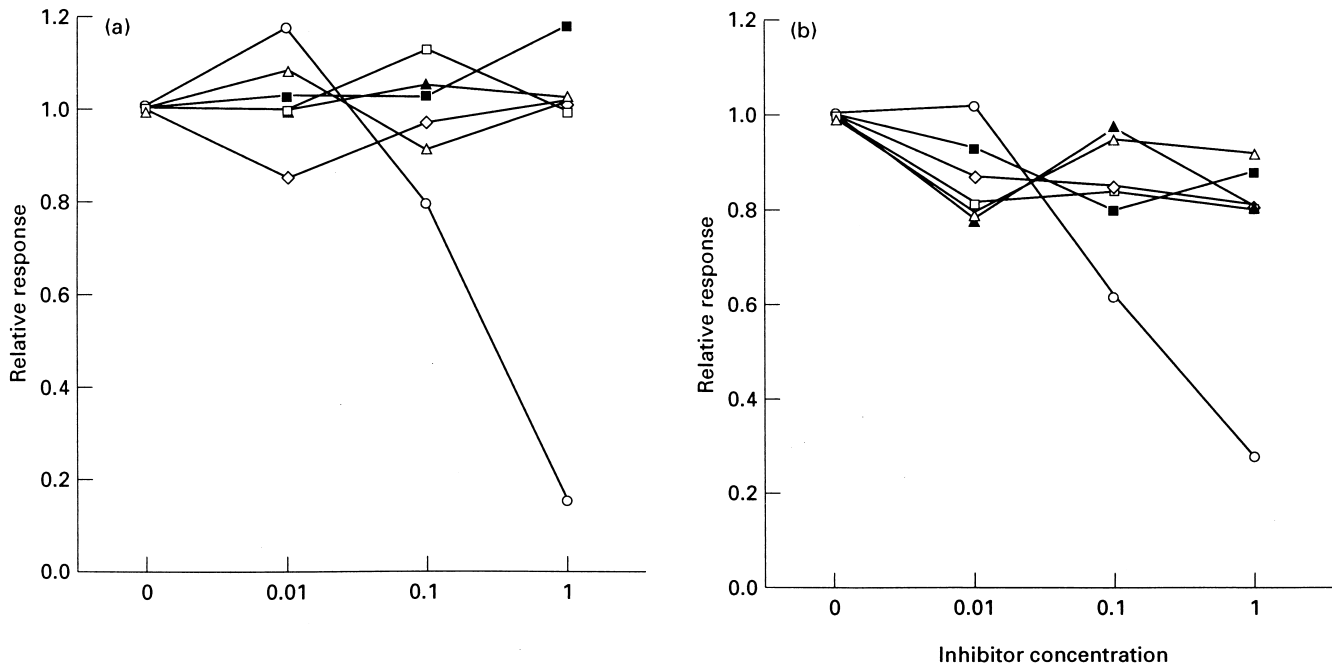


Fig. 2. Inhibition of asparagus-specific IgE binding to asparagus ImmunoCAP by dilutions of allergens according to Table 1. For definition of inhibitor concentrations 0 to 1, see Fig. 1. (a) Patient 1. (b) Patient 2.

be inhibited only by asparagus extract (Fig. 2). No evidence could be found of crossreactivity with any of the other allergens included in the study.

Heating, simulating boiling of the asparagus, effectively destroyed the allergenicity of the fresh asparagus extract. The boiled extract showed no inhibition, i.e. did not react with the IgE antibodies of any of the patients (Fig. 3).

Discussion

Fresh asparagus causing symptoms of an IgE-mediated inhalant allergy was identified in both case reports on the basis of the case histories, the results of the skin-prick tests with native green and white asparagus as well as the finding of increased specific IgE-antibodies. Both patients were atopic, sensitized additionally to pollens of grasses

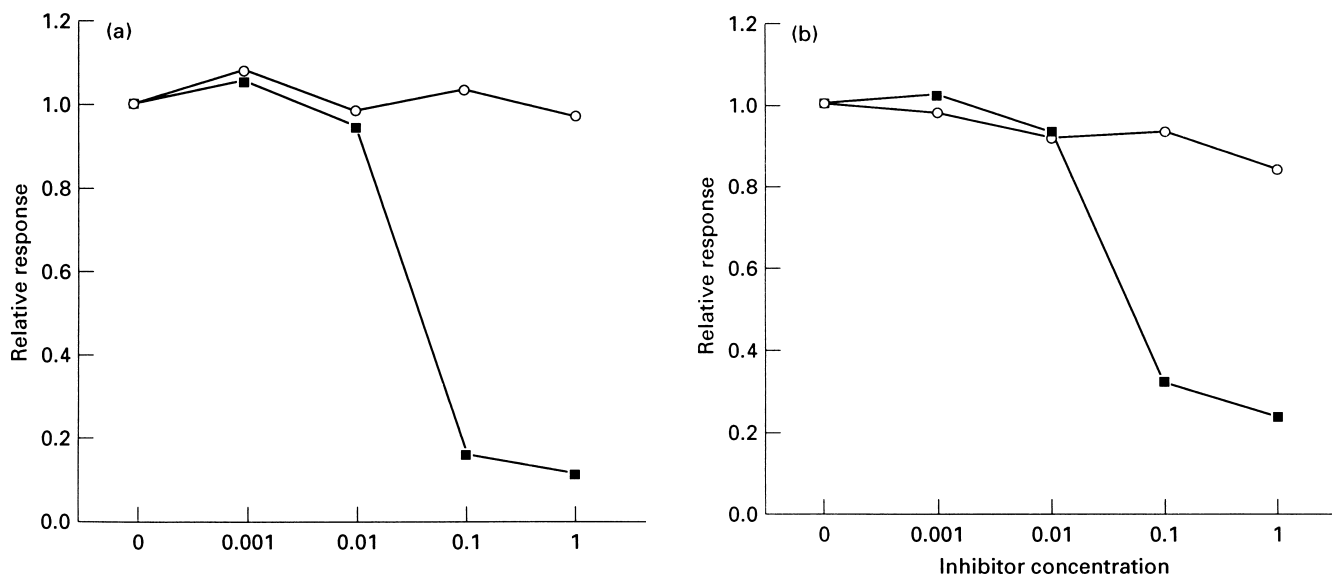


Fig. 3. Inhibition of asparagus-specific IgE binding to asparagus ImmunoCAP by dilutions of fresh and heated asparagus extract. For definition of inhibitor concentrations 0 and 1, see Fig. 1. (a) Patient 1. (b) Patient 2.

and trees. Furthermore, increased specific IgE to onion was documented in both patients. These findings suggested a possible crossreactivity between the concerning allergens.

Asparagus officinalis belongs to *Liliaceae*, one of the botanical families of the order *Liliflorae*. Other members of this group are garlic, onion and chives. There are a few reports about occupational asthma induced by inhalation of garlic dust [6,7]. One study revealed a cross-allergenicity between garlic and other members of the *Liliflorae in vitro* by the radioallergosorbent test (RAST) inhibition technique [8].

Our *in vitro* investigations of the two cases did not reveal any immunological crossreactions between asparagus and birch, *Bet v* I, profilin, mugwort as well as onion. The asparagus specific IgE in both cases was only inhibited by asparagus, indicating parallel multiple sensitivity.

Contact sensitivities to asparagus in an occupational setting are known [1,2]. With increasing use of machinery in canneries, there is less direct contact with asparagus, resulting in decreasing numbers of contact eczemas. There are no reports, however, of inhalant IgE-mediated allergies to asparagus.

In both of our case histories, eating of asparagus after cooking didn't provoke an oral allergy syndrome, as it is typical for instance in case of birch-pollen-associated food allergy to fruit and vegetable [9,10,11]. There were no gastrointestinal or respiratory symptoms after ingestion of this cooked vegetable either. So we assumed that the appropriate allergen fraction is denaturated during cooking processes. This could be confirmed by negative skin-prick tests with cooked asparagus and by lacking inhibition of asparagus-specific IgE antibodies with boiled instead of fresh asparagus extract.

We conclude, the two patients were specifically sensitized by asparagus. Direct contact of the allergen to the epithelia of the respiratory tract and conjunctiva during preparation of fresh asparagus can result in releasing allergic symptoms in presensitized individuals. No immunological crossreactions to pollen could be observed. The measurement of IgE antibodies to other allergens were

also specific, representing parallel multiple sensitivity as judged by the specific inhibition with homologous allergen. Profilin-inhibited profilin-specific IgE binding, but did not react with the asparagus-specific IgE-antibodies of these patients.

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