

Baker's asthma related to soybean lecithin exposure

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We report two cases of soybean-lecithin-induced asthma in bakers. The patients experienced clinical symptoms in relation to an occupational exposure to this additive. Skin tests were positive with soybean lecithin, RAST showed a sensitization to soybean, and bronchial challenge tests were positive for a dilution of 10^{-3} with this allergen. The same tests remained negative among healthy and asthmatic controls. Soybean lecithin, a common additive in bakery, must be added to the list of numerous aeroallergens involved in baker's asthma.

Key words: additives; baker; bronchial challenge test; lecithin; occupational asthma; soybean.

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Baker's asthma is a common occupational disease. Its prevalence varies among studies from 10 to 30% (9). Many allergens are involved (18), particularly wheat flour, but also contaminants and, more recently, additives. Some of these substances are well known by allergists; others are described in only a few publications. The role of α -amylase has been stressed by Flindt (11) since 1979, followed by other studies (2–5, 12, 17, 20). Only the study of Wüthrich & Baur (20) has pointed out the potent allergenicity of soybean lecithin among bakers, although occupational asthma caused by soybean flour exposure was reported more than 50 years ago (16).

We report here two cases of occupational asthma caused by soybean lecithin, a common additive in bakery.

Case reports

Case 1

A 26-year-old man reported recent episodes of rhinitis and asthma. He had been a technician in an industrial bakery for 5 years. His job was to prepare additive microdosages (α -amylase, citric acid, soybean lecithin) which are added to flour to hasten and economize the baking process. He had no history of allergy and did not know of any in his family. He was a nonsmoker.

The patient had developed rhinorrhea, cough with

sputum, and wheezing 3 months before. These symptoms recurred daily with an improvement on leaving work. They usually appeared 15 min after the beginning of work and then worsened, and he experienced nocturnal asthmatic attacks. Symptomatic treatments were not efficacious, and steroids were needed.

The patient thought that soybean lecithin might be responsible because rhinitis appeared shortly after contact with it. He stopped the exposure to lecithin and became asymptomatic without any treatment for 3 months. A reexposure challenge triggered recurrence of asthma.

Case 2

The patient was a 29-year-old baker. He was referred to our department because he exhibited a history of rhinitis and asthma. There was no known history of atopy. He was a nonsmoker and had worked in the same bakery, a small family business, since he was 18 years old. His brother was also a baker and reported allergic asthma to flour; his mother reported intrinsic asthma.

Our patient's symptoms of rhinitis had been present for 4 years. They appeared immediately on his starting work and cleared on holidays. For a few months, he had noticed an exacerbation of symptoms, including asthma, during his work. Wheezing and cough occurred whenever – once a week for

pastry cooking – he handled flour to which soybean lecithin had been added. The exacerbation of the symptoms was consistent with the use of this type of flour.

After a few months of symptomatic treatment, he changed his job and became asymptomatic within 2 months.

Material and methods

Extracts. Five grams of soybean lecithin, purchased by the patients, was incubated in 25 ml phosphate-buffered saline (PBS) for 24 h at 4°C with gentle agitation. After it had been strained through filter paper, the solution was passed through a millipore filter (0.22 µm). Dilutions up to 10^{-6} were made from the initial solution in PBS.

Skin tests. Skin testing was done with a standard prick test (Stallergènes) for common inhalant allergens in bakery and α -amylase. The positive control was histamine diphosphate 10 mg/ml. For soybean lecithin, skin tests were performed intradermally with the antigenic solution described above from a dilution of 10^{-6} . Soybean dust, flour (dilutions from $2 \cdot 10^{-6}$), and pulp (dilution from 10^{-6}) were tested intradermally with commercial extracts (I. Pasteur). All skin tests were examined after 20 min and 6 h.

Specific IgE. IgE antibodies were investigated by RAST (Pharmacia). For soybean, RAST was performed with the standard test (soybean flour). Specific IgE against lecithin was not investigated.

Bronchial challenge tests. The bronchial challenges were performed according to the guidelines for the diagnosis of occupational lung diseases (8). Base-line pulmonary function was normal at the time of bronchial challenge. Diluted soybean lecithin was generated by a Piglowski's bronchotest nebulizer. Tests were done during asymptomatic periods, without any medication at the time of examination. A PBS solution challenge was performed as negative control. The initial soybean lecithin solution was 10^{-6} , and then the allergen was given in progressively increasing concentrations with intervals of 30 min. Base-line pulmonary function tests were performed and repeated at 5, 10, and 30 min after each allergen inhalation. A positive immediate response was defined as a 20% fall in FEV₁. Then hourly controls were performed for 9 h after challenge, and the peak-flow measurements were recorded for 2 d.

Controls. Three nonatopic volunteers and three asthmatic patients were challenged as controls for skin tests and inhalation challenge to rule out a non-specific response.

Table 1. Results of skin tests and RAST in patients and controls. Skin prick tests were considered to be positive when the wheal was above 50% of area for histamine. Soybean allergens were tested intradermally. RAST was recorded as negative when less than 0.35 PRU/ml

	Skin tests			RAST ^o		
	Case 1	Case 2	Controls	Case 1	Case 2	Controls
Diluents	–	–	–			
Histamine diphosphate	8/12*	5/15	5/10 ⁺			
<i>D. pteronyssinus</i>	–	–	ND	–	–	ND
<i>D. farinae</i>	–	–	ND	–	–	ND
<i>T. putrescentiae</i>	–	–	ND	–	–	ND
<i>A. siro</i>	–	–	ND	–	–	ND
<i>G. domesticus</i>	–	–	ND	–	–	ND
<i>E. maynei</i>	–	–	ND	–	–	ND
<i>Penicillium</i>	–	–	ND	–	–	ND
<i>Alternaria</i>	–	–	ND	–	–	ND
<i>Aspergillus</i>	–	–	ND	–	–	ND
Grass pollen mix	–	–	ND	–	–	ND
Wheat flour	–	10/35	ND	–	5.5	ND
Bakery dust	–	8/20	ND	ND	ND	ND
Ephestia	–	–	ND	ND	ND	ND
Cockroach	–	–	ND	–	–	ND
α -Amylase	–	–	ND	–	–	–
Soybean lecithin (10^{-4})	30/50**	20/30**	–	ND	ND	ND
Soybean dust ($2 \cdot 10^{-5}$)	8/20**	5/10**	–	ND	ND	ND
Soybean flour ($2 \cdot 10^{-5}$)	20/40**	15/30**	–	10.5	2.3	–
Soybean pulp (10^{-5})	12/24**	8/15**	–	ND	ND	ND

* Papula/erythema; ^o PRU/ml; ND: not done; ⁺ mean value; ** intradermal.

Results

Skin prick tests with common bakery extracts were negative in the first patient. Wheat flour and bakery dust were positive in the second patient (Table 1). The skin tests with soybean lecithin were positive in the two patients at a concentration of 10^{-4} , causing wheals of 30 and 20 mm, respectively. No late reaction was noted. Soybean extracts were also positive for dust and flour (dilution $2 \cdot 10^{-5}$) and pulp (dilution 10^{-5}) in the two patients. Specific IgE determinations showed a positive RAST only to wheat in the second patient. Other bakery allergens remained negative. Specific IgE for soybean flour was found in the two sera with 10.5 and 2.3 PRU/ml, respectively.

A drop of 45% in FEV_1 was observed 5 min after an inhalation of a 10^{-3} dilution in the first patient, and a drop of 50% was noted for the second patient at the same dilution (Fig. 1) after 10 min. No significant late reaction was observed. None of the control subjects showed any reaction in skin tests or bronchial challenges.

Discussion

Baking additives have been recently implicated in occupational asthma in the bakery and confectionary industries (2). In fact, additives are used to improve the quality of bread and baking. Wax bean flour, soybean flour, malt, α -amylase, gluten, ascorbic acid, and several preservatives are currently mixed with wheat flour. Soybean lecithin, E322, at a maximum content of 0.015% in France, is used to aid the hydration, fermentation, elasticity, and preservation of bread. This substance contains phospholipids which act as emulsifiers.

It has been stressed that bakery additives must be routinely tested in cases of flour allergy before im-

muno-therapy (17). We think that soybean lecithin, because of its frequent use, should also be included in the battery of tests. In cases of concomitant allergy, this could avoid some failures of immunotherapy with a wheat flour extract (1).

A sensitization to soybean flour in bakers has been described by Bush et al. (7) and Baur et al. (2) with 21% positivity in immunoblotting methods. Wüthrich & Baur (20) also reported frequent sensitization to a soybean lecithin preparation (65%), as compared with α -amylase (sensitization of 55%), in symptomatic subjects. Scratch tests were positive and also RAST to soybean flour in 19.3% of the cases. Trypsin inhibitor and lipo-oxylase, the main allergens of soybean (7, 14), were suspected to be responsible. Indeed, soybean lecithin is essentially lipidic and is theoretically of a poor immunogenicity, but proteic impurities are usually present, in a content of 2–4%, according to the manufacturers. The allergens may be included in these impurities. We have not yet detected a common allergen between soybean lecithin and soybean flour, dust, or pulp, but results of prick tests and RAST support this hypothesis. We must add that lecithin can play a role as a lectin and does enhance allergenic reactivity. Soybean lecithin has been also involved in drug allergy to lipidic emulsions, as shown by Nicolas et al. (15).

Soybean allergens are known as hidden allergens in food allergy (13, 14). They are added to some foods such as pastry and meat. This has to be taken into account in dietary prescriptions for children presenting with soybean formula milk allergy (13, 19), or in any other patient presenting with soybean allergy. However, pure soybean oil seems to be non-allergenic (6).

We have shown that soybean lecithin, known to induce high sensitization in bakers, can provoke asthma attacks, because bronchial challenges were positive in our two patients. This must be related to the recent study by Fine (10) in which soybean lecithin, contained in aerosols, was implicated in bronchospasms induced by asthma treatment.

We think that this allergen must be systematically tested in baker's asthma.

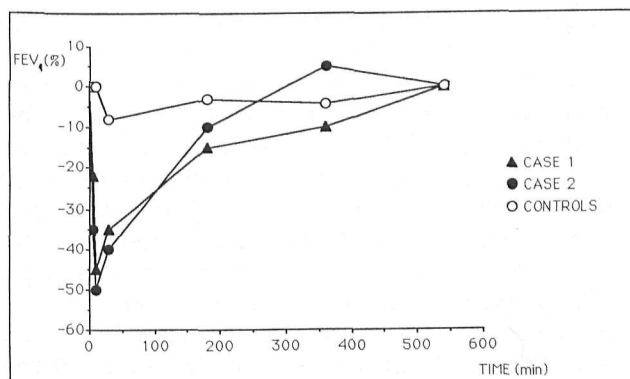


Fig. 1. Bronchial challenge tests with soybean lecithin. Results are shown for a dilution of 10^{-3} for patients and 10^{-1} for controls. Base-line pulmonary function was normal in the two patients with FEV_1 of 105 and 97% of predicted values, respectively.

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