

Occupational asthma caused by inhalation of casein

J. M. OLAGUIBEL¹, D. HERNANDEZ¹, P. MORALES², A. PERIS¹ & A. BASOMBA¹

Departments of ¹Allergy and ²Respiratory Medicine, Hospital la Fe, Valencia, Spain

Solutions of casein are usually sprayed over the leather in the final stage of tanning. We present the result of a thorough investigation of an atopic tannery worker with occupational asthma. Data from clinical record and metacholine challenges support the occupational source of the patient's symptoms, and positive bronchial challenge with casein clearly defines it as the specific aetiological agent. The presence of specific IgE suggests a hypersensitivity type I mechanism. In the tanning process chromium salts, paraphenylenediamine and formaldehyde have all been included as specific aetiological agents of asthma, but occupational asthma induced by inhalation of casein has not previously been reported.

Key words: allergy; asthma; casein; occupational disease; tanning.

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Many agents in the work environment can induce bronchial asthma. With the introduction of new substances in industry and the increased awareness among physicians, the list is growing (1). Chromium salts, paraphenylenediamine and formaldehyde, have all been included as specific aetiological agents of bronchial asthma in tanneries (13, 14).

Caseins are the principal proteins of cow's milk. IgE-mediated diseases induced by the oral ingestion of casein are well recognised (6). In the finishing process at tanneries, after the leather leaves the chrome tanning drums, it is usually sprayed with casein, and the workers thus inhale casein in variable amounts (11). We present the results of a thorough investigation performed in an atopic tannery worker suffering from occupational asthma after exposure to aerosolized casein for 3 months.

PATIENT AND METHODS

A 37-year-old man, non-smoker, with a 1-year history of rhinitis, cough and wheezing

dyspnea, had clearly noted that his symptoms deteriorated at work and improved at weekends or on vacation. He had been working in the finishing section of a tannery for 12 years, but 3 months before the onset of symptoms, a new product (Episan-top 3-17/1, Henkel SA) was introduced in the finish formula.

The manufacturer confirmed that Episan-top was a water solution of modified casein at 20 % p:v. Cow's milk was well tolerated by the patient.

At the initial assessment standard skin prick tests were 3+ for *D. pteronyssinus*, 3+ for cat epithelium and 3+ for casein (Abello, Madrid), (histamine 10 mg/ml = 3+). A standard RAST assay (Phadebas, Pharmacia) was class 2 (2.7 PRU) for casein, and total IgE was 240 U/ml. As a control, the serum of a tannery worker from the same section was investigated for specific IgE against casein with negative result. Methacholine inhalation challenge after 2 weeks leave from work showed a PC₂₀ of 2 mg/ml (4).

A second assessment was performed 8 months later. The patient stayed away from exposure and remained asymptomatic without

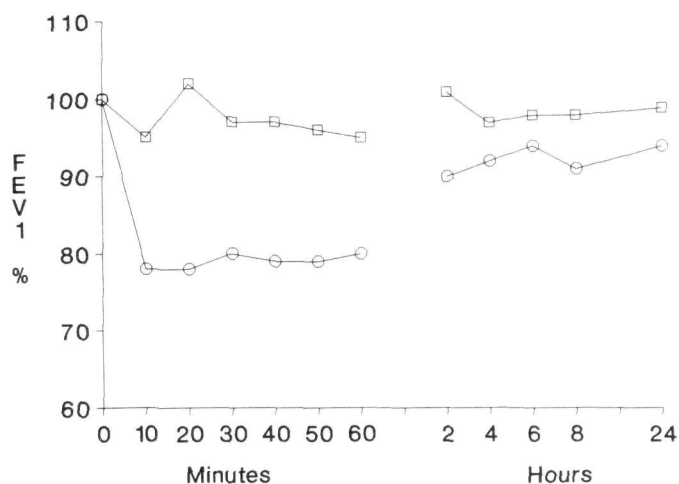


Fig. 1. Bronchial challenges with casein. ○ Casein 50 mg/ml. □ Control.

treatment. Methacholine inhalation challenge was again positive but PC_{20} had increased to 8 mg/ml. Bronchial provocation tests were performed by the tidal breathing method (8). Aerosols were delivered by a De Vilbis 646 nebulizer, with an output of 0.240 ml/min. Buffered solutions of casein in normal saline at 10 and 50 mg/ml were prepared and inhaled for 5 min. An immediate reaction was recorded after inhalation of the 50 mg/ml solution, with a 22% decrease in FEV_1 that lasted 1 h. No late reaction was recorded (Fig. 1). The casein solution, used at work, had a five times higher concentration. Bronchial challenges with casein in three asthmatic control subjects were negative.

DISCUSSION

The objectives of tanning are to render hides and skins resistant to decomposition or bacterial decay, to improve certain physical properties, such as tensile strength, abrasion resistance and permeability, and to impart to the leather such chemical properties as nonsolubility in water at high temperatures. When removed from the chrome tanning drums, leather is in a condition described as rough tanned and must be subjected to a series of finishing steps. These processes include drying, fat-liquoring, currying and stuffing, dyeing and final finishing. Leather that is to have a smooth, polished, or lustrous finish is subjected to a series of related processing steps. These are intended to create a

surface that is integrated with the leather, resistant to abrasion, capable of withstanding moisture and high temperature variations without impairing the ability of leather to transpire. To achieve these qualities, several coats of prepared finish, in which dye or pigment may be included, are applied in succession to the leather. Materials ranging from casein, albumin and wax to complex resins and lacquers are embodied in the finish formulas. These are applied by machine or hand through sprays or rollers (11).

To the best of our knowledge, occupational asthma induced by inhalation of casein has not previously been reported, but the data from the clinical record and sequential methacholine challenges support the occupational source of our patient's symptoms. Positive bronchial challenge with casein clearly defines it as the specific aetiological agent. Occupational respiratory diseases in milk-product industries, e.g. cheese washer's disease or cheese workers' lung, are caused by inhalation of spores from molds of the genera *Aspergillus* or *Penicillium* (16).

It is well known that food allergy is a cause of asthma exacerbation (15). In some work environments, food allergens come in close contact not with the gastrointestinal tract but with respiratory mucosae, leading to the onset of asthma. An IgE-mediated mechanism is usually involved (9), and a course of immunotherapy can be of help in symptom relief (12). Bakers' asthma (17), occupational asthma of snow crab-processing workers (12) or bromelain-induced asthma (5) are good examples. Asthmatic bakers tolerate perfectly well the ingestion of wheat-derived products (10); our patient tolerated cow's milk. It appears that in our subject the continuous exposure linked to the different route of allergen entry, has lead to an aberrant immunological response and disease. It has been stated that chronic low-dose exposure, by the inhalation route in a genetically susceptible host, may induce an IgE response in animals and humans (13).

Specific IgE against the major proteins of bovine whey has been detected by crossed radioimmuno-electrophoresis (CRIE) in the sera

of milk-allergic children and in normal adults. However, IgE against casein has only been found in milk-allergic patients (7). It is therefore our opinion that the presence of specific IgE for casein in our patient's serum is a significant indication that his symptoms were IgE-mediated.

Our case story emphasizes the importance of allergen entry to the genesis of allergic disease. Casein should be added to the long list of aetiological agents in occupational bronchial asthma.

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Address:
Dr. J. M. Olaguibel
CS Conde Oliveto. Unidad de Alergología
Avda. Conde Oliveto, 9
31002 Pamplona
Spain

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