

The possible role of cockroaches in baker's asthma

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KEY WORDS

Occupational asthma; cereal dust; wheat flour dust; cockroach allergy; peak flow monitoring; bakery workers

SUMMARY

Background: Baker's asthma is related to wheat flour exposure and to other cereal dust exposure. **Objectives:** The cockroach is considered a significant allergen and can occasionally trigger asthma in bakery workers. **Methods:** The case of a 33-year-old male, suffering from asthma in the workplace with previous equivocal tests for cereal dust was investigated. Clinical assessment of the worker consisted of cutaneous and blood screening for common and occupational allergens, including cockroach. The subject was monitored for aspecific bronchial reactivity and peak flow in a cockroach disinfected workplace, and these data were compared to data obtained after previous workplace exposure. **Results:** The worker was not allergic to wheat and other cereal dusts or alpha-amylase, but was sensitized to cockroach. His asthmatic symptoms disappeared, and bronchial reactivity varied after a long period outside the bakery workplace. PEF monitoring, that had showed diurnal variability >20% and differences between working and non-working periods, demonstrated both normal values and daily variations less than 10% when he returned to the cockroach disinfected workplace. **Conclusions:** The cockroach is a common allergen, however no case of work-related baker's asthma due to the cockroach has been previously described. Clinical history and analysis of the allergens at the workplace must direct the clinical approach of the investigators, in order to correctly evaluate the subject and enable him/her to resume work.

RIASSUNTO

«Asma da farina di frumento. Un possibile ruolo della blatella germanica». L'asma del panificatore (baker's asthma) è tradizionalmente imputata alle farine di frumento, anche se altri allergeni alimentari e miglioratori nel processo della panificazione, tra cui soprattutto l'alfa-amilasi, sono stati identificati quali allergeni in grado di sensibilizzare e scatenare sintomi respiratori. Ad oggi non sono stati mai descritti casi di asma bronchiale allergico professionale correlato alla presenza di blatella germanica, che per altro è un contaminante dell'ambiente lavorativo. Il caso descritto nell'articolo riguarda un artigiano, diagnosticato in passato come affetto da asma da acari e, per la presenza di IgE specifiche verso orzo e mais, allontanato dall'attività produttiva con serie ripercussioni economiche. Dopo 5 anni il paziente si è sottoposto ad accertamenti presso il nostro centro, da cui sono state confermate le positività sierologiche e cutanee per gli acari, e per le gramminacee, ma tutti gli allergeni di uso professionale testati con diversi tipi di estratti e con metodologie analitiche diverse per le IgE specifiche (Cap System e Immulite) sono risultati negativi. I rilievi ambientali hanno evidenziato un'elevata concentrazione di allergeni di blatella germanica nelle polveri di laboratorio, a fronte di una marcata positività cutanea e sierologica. L'intervento di bonifica, i cui effetti sono stati monitorati, ha permesso il reinserimento lavorativo del soggetto, controllato nel tempo. Le nostre considerazioni finali sono che l'approccio ai pazienti con esposizioni ad allergeni professionali richiede la compe-

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tenza di centri di medicina occupazionale, al fine di inquadrare correttamente il lavoratore, permettendo di definire opportunamente il quadro clinico e di discriminare la forma professionale da quelle di altra natura. Nel nostro caso la sintomatologia respiratoria era legata alla presenza della blatella germanica che, pur essendo un allergene ubiquitario, in Italia risulta scarsamente rappresentato negli ambienti domestici. Gli interventi di bonifica effettuati nell'ambiente di lavoro hanno portato alla scomparsa della sintomatologia e permesso il reinserimento lavorativo.

INTRODUCTION

Several studies suggested that a considerable number of workers, without positive SPT or specific IgE to flour extracts and other allergens from the bakery environment, have work-related asthma symptoms (8). Many allergens have been identified so far (9), including other cereal flours (21, 23), baking additives like soybean flour (3), moulds (24), different enzymes (hemicellulase, protease, papain, glucoamylase) (2), foods (6). No case of asthma due to cockroach has yet been described, although it has been considered (1). Indeed, the cockroach is an extremely significant allergen all over the world (11, 25), although in Italy sensitization to the cockroach is low in the general population (10, 19).

Cockroach infestation has been identified in Italian bakeries (17). Many small bakeries have adopted procedures to control and prevent the development of cockroach infestation via inspection by the National Health Service. However, neither epidemiological studies nor in-depth analysis of bakery workers have included this allergen in diagnostic panels. Here we describe a case of baker's asthma due to cockroach exposure.

CASE REPORT

FM, 33 yrs male, had worked for 10 years as baker in his own bakery. In the last 7 years he had initially developed rhinitis, and a gradual cough, chest tightness and asthma which were work-related (on-off test positive). He was evaluated by SPT for common allergens in different hospitals in northern Italy. He tested positive to house dust mite, pollens (olive tree, weed and grass pollens) cat, dog and was sensitized to some foods (egg

yolk, tomato, maize, cod, rice and barley). Oddly, he was not screened using cutaneous tests for wheat flour, but he was found to have specific IgE for soybean, rye, shrimp, crab and house dust mites (classes 2 and 3). Bronchial challenge with methacholine yielded positive results (PD₂₀ FEV-1 500 µg) and monitoring of Peak Flow showed differences in diurnal variability >20%, which was reduced during the week-end. Patch tests (GIRDCA European standard series) were positive for potassium dichromate (++) . He was definitely diagnosed with asthma due to house dust mite in an atopic subject, at high risk for occupational disease. Therefore, he stopped bakery work for 5 years. He worked selling and delivering his bakery products, and was only occasionally exposed in the bakery itself. He reported rhinitis and occasionally asthma at work when he remained much more than 1 hour in the bakery production area. Objective adverse effects such as acute skin rash, angio-edema and asthma were observed with shrimps and crabs after ingestion. For several years he treated the respiratory symptoms with steroids and Beta₂ long-acting therapy. He came to our clinic for reassessment of his clinical condition and to consider the possibility of relocation in the work place as a baker.

The patient underwent SPT for a panel of allergens: house dust mite (Der p1 and Der f1), dog, cat, moulds (*Alternaria alternata* and *Cladosporium*) grass, tree and weed pollens. Additional tests using SPT for soybean, maize, rye, malt, grain, *Saccharomyces cerevisiae*, *Candida albicans*, (both Lofarma Allergeni, Italy and Stallergenes, France), cockroach, and alpha amylase (Stallergenes France) were made. A standard series of tests for food allergens (Lofarma Allergeni, Italy) was performed in order to evaluate previous positive cutaneous tests. Further tests with prick-by-prick with grain seed, barley, rye, maize, tomato were also performed (18). Tests

with a wheal >3 mm diameter were considered positive; control positive tests with histamine (6 mm) and negative tests with saline solution were performed. The patient tested positive to house dust mites (3 mm), weed and grass pollens (4 mm). He was also positive to cockroach (8 mm wheal).

Specific IgE for Soybean, maize, rye, malt, alpha amylase, grain, *Saccaromyces cerevisiae*, were performed using two different methods: Cap System (Pharmacia Upjohn, Sweden) and Immulite 2000 (Medical System spa, Italy). The results were negative using both methods.

Cockroach, crabs and shrimps, determined only by the Cap System, tested positive, and were respectively 11,7 KUA/l, 2,5 KUA/l and 5,6/KUA/l. House dust mite and storage mites (*Acarus siro*, *Lepidoglyphus destructor*, *Glycophagus domesticus*) were also detected with positive results only for Der f1 6,67 KUA/l and Der p1 7,99 KUA/l.

Pulmonary function was normal and no bronchial hyper-reactivity was observed in the challenge with methacoline (7). Eosinophil cationic protein was detected with a negative result (9,69 KUA).

The patient underwent an epicutaneous test (standard series for bakery workers (Firma, Italy)

which were negative after 48, 76 and 92 hours. Given these clinical results, the subject was permitted to return to his own place of work, and the concentration of cockroach allergen in dust samples was determined before and after proven disinfection according to a method previously described (16). Before the disinfection the value was Bla g1 20 U/g. No detectable concentrations of cockroach were found after the environmental improvement (disinfection with Actogard, Novartis). The subject returned to chronic exposure to flour dust. Serial peak flow measurements were taken by peak flow meter (Vitalograph Peak Flow Meter, UK) four times a day. The results were recorded by the worker over a period of six months, including weekends and holidays. He did not take any medication, except B₂ short-acting therapy when necessary, and he was controlled every two months as an outpatient. He did not show any respiratory symptoms.

PEF monitoring demonstrated normal values for age, height and sex (14). No daily variations exceeding 10% of basal values nor any differences between working and non-working periods were recorded. The clinical data concerning the different periods of observation are summarized in table 1.

Table 1 - First examination of the patient and re-assessment in order to allow return to work. The table shows the main tests performed and reports the results obtained

Test	First examination	Occupational re-assessment
SPT inhalants	Positive: house dust mites, olive tree, weed, grass pollens, cat, dog	Positive: house dust mites, weed, grass pollens, cockroach
SPT food	Positive: egg yolk, tomato, maize, cod, rice and barley	Negative SPT food Negative: soybean, maize, rye, malt, grain, <i>Saccaromyces cerevisiae</i>
Prick-prick fresh food		Negative: grain seed, barley, rye, maize, tomato
Specific IgE	Soybean, rye, shrimp (class II), crab and house dust mites (class III)	Soybean, maize, rye, malt, alpha amylase, grain, <i>Saccaromyces cerevisiae</i> =class 0 shrimp and crab (class III and II), house dust mites (class III) Cockroach (classIII)
Challenge with Methacoline	Positive 500 mcg PD20 – FEV-1	Negative
Peak flow meter monitoring	Diurnal variability >20%, No variability during weekend	No variability after disinfection of the workplace
Patch tests	Potassium dichromate ++	Negative standard series for bakery workers

DISCUSSION

Baker's asthma is one of the most common forms of occupational asthma. The presence of flour allergy is usually included in the definition of Baker's asthma from the clinical viewpoint (1).

The occupational and clinical history must be fully recorded as well as the workplace conditions and the products in use (cereal flours, soybean, rice, alpha-amylase, etc.). The occasionally positive SPT to some cereal flours, or the presence of IgE-specific antibodies, might be considered as a possible cross-reactivity and evaluated in an occupational context. Specific bronchial challenge with occupational substances suspected for specific bronchial reactivity could be performed as the gold standard for occupational asthma, although clinical history, cutaneous tests, IgE antibodies and serial peak flow measurements can be valid tools in diagnosing occupational asthma (8).

Moreover, carrying out two different SPT panels for bakers, prick-by-prick and the detection of specific IgE with different methods (CAP System and Immulite 2000) showed negative results. In a previous study on bakery workers we observed that both the use of multiple different diagnostic methods and a work-orientated symptoms questionnaire showed a statistically significant concordance (17). Such findings suggest that the patient, according to both the clinical history (adverse reaction to seafood, shrimps and crab) and the previous exposure (he used only wheat flour without adding enzymes), was not allergic to wheat and cereal flours. In fact both the negative SPT for all the cereal flour dusts and the relative IgE-specific antibodies confirmed our opinion. For this reason it was not necessary to perform bronchial challenge with flour dust, which gives limited results either due to not very well standardized methods or to the presence of other allergens and contaminants (5). It should be noted that we found sensitization to the cockroach. In such a case it might be possible to make a specific challenge, but the patient's respiratory symptoms improved after disinfection in the workplace. As in this case, previous studies showed high levels of cockroach allergen and very low concentrations of house dust and storage mites (17, 22).

Different indoor studies, not including bakeries, confirmed that the cockroach cannot be considered a substantial risk factor for allergy in Italy (12, 13, 15). Moreover, De Zotti et al. also observed that the risk of work-related symptoms in baker's asthma was not associated with sensitization to house and storage mites (4). In the subject under study IgE-specific tests for storage mite were negative. The previous positive test for soybean and rye, which were not present at the workplace and were not confirmed by our multiple tests, can be interpreted as an occasional cross-reaction due to grass pollen and probably as a lack of sensibility/specificity of the diagnostic method used (20). In the last few years, however, there has been an improvement in the extracts for diagnostic use.

The monitoring of the PEF was negative during the six months' follow-up. No medication was taken in that period. The environmental conditions had not varied, with the exception of cockroach disinfection. The worker did not change his lifestyle, excluding exposure in the workplace and, obviously, the consumption of seafood. The patient worked without problems, and the workplace was regularly disinfected. This case emphasizes the importance of a thorough analysis of the workplace, including all possible allergens, with clinical assessment and symptoms monitoring after return to occupational exposure. The clinical history and the allergens at the workplace must direct the clinical approach of the investigators, in order to correctly assess the subject and enable him to return to work. Environmental measures to control exposure to different allergens are recommended.

NO POTENTIAL CONFLICT OF INTEREST RELEVANT TO THIS ARTICLE WAS REPORTED

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