Case Report

Allergy to freshwater shrimp *(Gammarus)*

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Summary. We report three new cases of allergy to *Gammarus*, two of them involving cutaneous symptoms, and the third one with occupational asthma.
The results showed exposure to feed containing *Gammarus* shrimp to be the main cause of the allergic symptoms in the three patients.
In all cases the intervention of IgE was demonstrated, with the absence of cross-reactions with other common allergenic arthropods.

Key words: *Gammarus*, freshwater shrimp, asthma, urticaria, tropomyosin

Introduction

Gammarus is a crustacean belonging to the order Amphipoda that is not included in the data collection of common allergic genera of Crustacea: *Metapenaeus*, *Palinurus*, *Penaeus*, *Leander*, *Homarus* or *Pandalus*.

Although freshwater shrimp constitutes indispensable biological feed in fish factories, the poultry industry, animal husbandry and aquariophilia, to date *Gammarus* has been reported as a cause of respiratory allergy in only two patients: one with occupational asthma [1] and another one with rhinitis caused by food for pet turtles [2].

The present study reports three new cases of allergy to *Gammarus*, two of them with cutaneous symptoms, and the third one with occupational asthma.

Case 1:

A 13-year-old boy with a history of allergic rhinitis due to *D. pteronyssinus*, presented with urticaria symptoms associated with the manipulation of a turtle aquarium since October 2002. Skin prick tests with *Gammarus* and a standard panel of allergens including, mites (*Dermatophagoides*), common local pollens (mixture of wild grasses, *Artemisia*, *Chenopodium*, *Parietaria*, *Platanus*, *Olea* and *Cupressus*), epithelia (cat and dog) and moulds (*Alternaria*, *Aspergillus*, *Penicillium* and *Cladosporium*), were positive to *Dermatophagoides* and *Gammarus*. IgE dot-immunobinding [3] with native (non-treated samples) and denaturized (samples boiled for 5 minutes in buffer containing SDS and 2-mercaptoethanol) *Gammarus* extracts, proved positive only for the native proteins (Figure 1a). Specific IgE performed by ImmunoCAP was positive for *Dermatophagoides* and *Blomia*, and negative for *Gammarus*, shrimp, cockroach (*Blatella germanica*, *Blatta orientalis* and *Periplaneta americana*), nematodes (*Anisakis*, *Ascaris* and *Toxocara*), fish food (hake, tuna, sardine, cod and salmon) and tropomyosin. Immunoblotting [4] with serum from a non-atopic subject yielded no positive reaction. The serum of the patient did not show any IgE binding component. After avoidance of exposure to *Gammarus*, the patient presented no further urticarial symptoms.

Case 2:

A 38-year-old man with no personal history of allergy, who worked in a pet food factory developed asthma symptoms immediately after manipulation of dry *Gammarus*. Skin prick tests with *Gammarus* and the

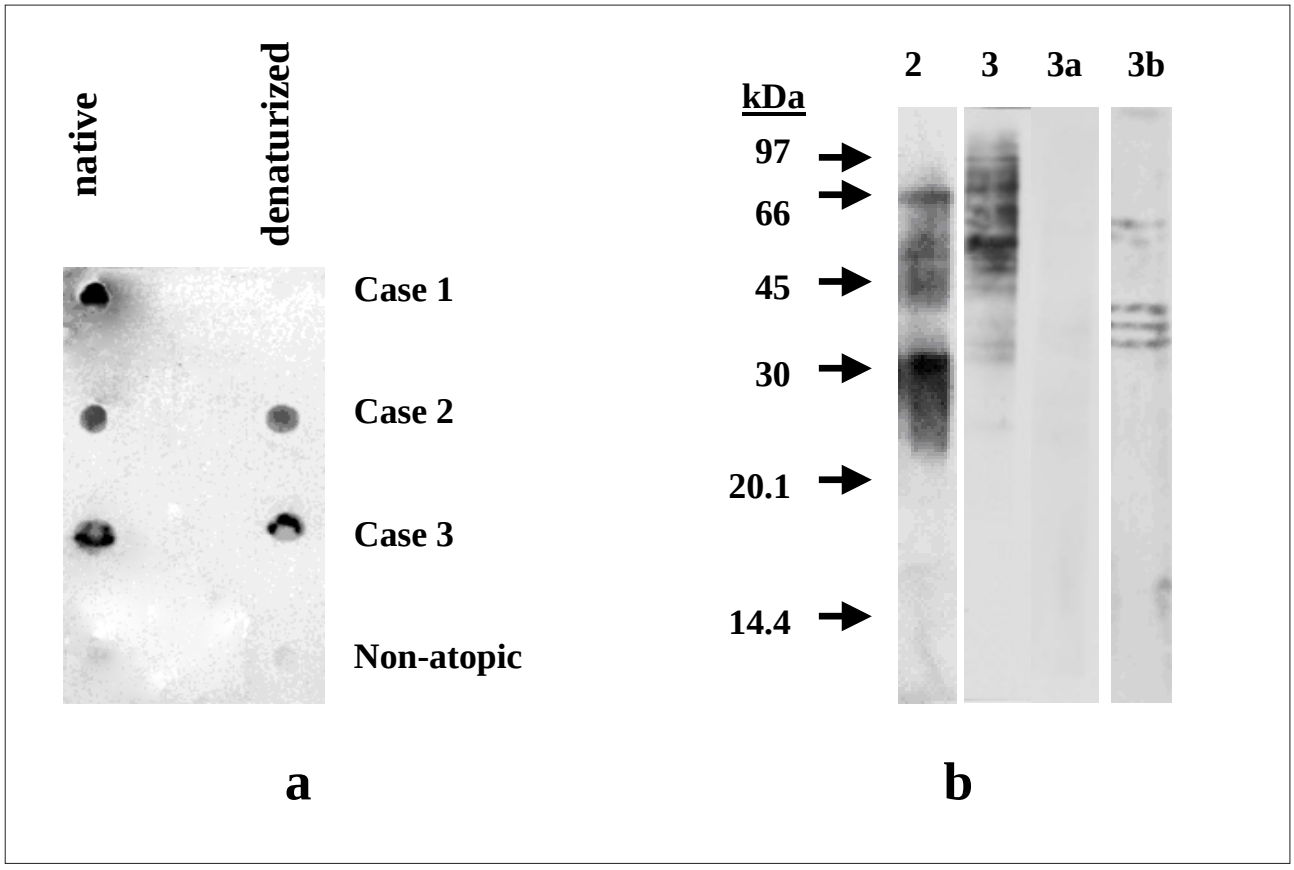

Figure 1. a) IgE-dot-immunobinding of sera from patients with allergy to *Gammarus*. b) SDS-PAGE IgE-immunoblotting of sera from patients corresponding to case reports 2 (lane 2) and 3 (lane 3). SDS-PAGE IgE-immunoblotting-inhibition of serum from patient corresponding to case report 3, inhibited with *Gammarus* extract (lane 3a) and with *Dermatophagoides pteronyssinus* extract (lane 3b).

above mentioned standard panel of allergens were positive to *Gammarus*, cat and *Artemisia*. Specific IgE performed by ImmunoCAP proved positive (1.2 kU/ml) for *Gammarus* and negative for shrimp, *D. pteronyssinus*, *B. tropicalis*, cockroach, nematodes, fish food and tropomyosin. IgE dot-immunobinding [3] with native and denaturized *Gammarus* extract were positive (Figure 1a). Immunoblotting [4] with serum from a non-atopic subject yielded no positive reaction. The patient serum showed 7 different bands ranging from 70 to 20 kDa. The components corresponding to 65 and 30 kDa, revealed the highest specific IgE binding capacity (Figure 1b). After avoidance of exposure to *Gammarus*, the patient improved, reverting to his usual condition.

Case 3:

An 11-year-old girl with a personal history of allergy, presented with allergic rhinitis and mild intermittent bronchial asthma, with sensitization to common house dust mites and grass pollen for the last 7 years. The symptoms were controlled with immunotherapy to *Dermatophagoides* and intermittent application of symptomatic treatment. Since April 2003 she showed urticaria symptoms associated to the manipulation of a turtle aquarium.

Skin prick tests with *Gammarus* and the above mentioned standard panel of allergens resulted positive to *Dermatophagoides*, pollen grasses and *Gammarus*. IgE dot-immunobinding [3] with native and denaturized *Gammarus* extract proved positive (Figure 1a). Specific IgE performed by ImmunoCAP was positive for *Gammarus* (2.4 kU/L) and *Dermatophagoides*, and negative for shrimp, cockroach, nematodes, fish food and tropomyosin. Immunoblotting [4] with serum from a non-atopic subject yielded no positive reaction. The serum of the patient showed 12 different bands ranging from 100 to 30 kDa. The components corresponding to 80 and 50 kDa revealed the highest specific IgE binding capacity (Figure 1b). After avoidance of exposure to *Gammarus* the patient improved, reverting to her usual condition.

Skin prick tests with *Gammarus* extract performed in 5 non-atopic subjects and in 5 mite-sensitized patients proved negative.

The immunoblotting results showed significant differences between the two profiles identified. Unlike patterns reported for the other cases of allergy to *Gammarus*, in this study a large number of IgE binding components was detected. Only patient 3 revealed specific IgE against an 80 kDa component, coinciding with the size of the component detected by Baur et al. [1].

As Pen a 1 (shrimp major allergen identified as tropomyosin) can be considered the main component responsible for cross-reactivity with other invertebrate crustaceans, mollusks, arachnids and insects [5-7], and the patients evaluated in the present study only reacted to house dust mites as allergens of animal origin, we decided to study the implication of tropomyosin in possible immunological cross-reactions between *Dermatophagoides* and *Gammarus*. The demonstration of non-detectable levels of IgE anti-tropomyosin in the sera tested, suggests the non-intervention of this allergen in possible cross-reactivity phenomena. In addition, immunoblotting inhibition showed scarce cross-reactivity between *Gammarus* and *D. pteronyssinus* allergenic extracts (Figure 1b, lanes 3, 3a and 3b). Inhibition of serum from patient corresponding to case 3 using *Gammarus* in solid phase and house dust mite as inhibitor revealed 6 non-shared components with MW of 31.0, 37.0, 38.5, 40.5, 56.0 and 60.5 kDa (Fig. 1b, lane 3b). These results suggest that *Gammarus* sensitization occurred in these patients was produced without the intervention of cross-reactions.

From the above results we conclude that exposure to feed containing *Gammarus* freshwater shrimp was the main cause of the occupational asthma in one patient and of the urticaria symptoms in the other two subjects. In all cases the intervention of IgE could be proven, and very few or no cross-reactions with other common allergenic arthropods could be detected. No other cases of *Gammarus* allergy involving cutaneous symptoms have been described in the literature to date.

Despite the few cases of allergy to Gammarus described, a great variability in symptom expression and allergenic profiles has been demonstrated.

References

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