

# Monospecific allergy to swordfish

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**Background:** Fish allergy is a relatively common and potentially fatal condition. Most fish allergic subjects are allergic to multiple fish species. We encountered a patient clinically allergic only to swordfish.

**Objective:** To characterize the *in vivo* and *in vitro* IgE antibody responsiveness of this patient solely allergic to swordfish.

**Methods:** Prick skin tests, as well as immunoassay and protein immunoblotting for IgE antibody were performed using commercial fish extracts and fresh swordfish. A more typical multiple fish-allergic subject and a subject not allergic to food were also studied for comparison.

**Results:** The multiple fish-allergic subject demonstrated IgE antibody to a 13-kD protein in all fish tested (probably Gad c 1 and its analogues in other fish). The swordfish-allergic subject did not recognize this 13-kD band but did demonstrate IgE directed against a 25-kD band only in swordfish. The negative control showed no IgE binding to either the 13 or 25 kD bands.

**Conclusions:** It is possible to be allergic to a single fish species, such as swordfish, and such monospecific allergy may be due to the presence of species-specific allergens, in this case a 25-kD allergen in swordfish.

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## INTRODUCTION

Fish is a relatively common food allergen<sup>1</sup> and may cause fatal anaphylactic reactions.<sup>2</sup> Fish-allergic subjects usually demonstrate IgE antibody to a large number of fish species, although clinical cross-reactivity may be more limited.<sup>3</sup> We report a patient clinically allergic to swordfish but to no other fish. This exclusive sensitivity was confirmed by *in vivo* and *in vitro* testing, and a unique swordfish allergen was identified.

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## CASE REPORT

A 39-year-old man reported that whenever he ate swordfish, about an hour later, he would be covered with hives and have nausea, vomiting, and shortness of breath. These reactions had occurred on at least four occasions including one in which the swordfish was found unexpectedly in a fish stew. He maintained that this reaction did not happen with any other fish; he regularly ate fish such as cod and halibut without difficulty.

The patient was prick skin tested with ten commercial fish extracts (catfish, cod, halibut, salmon, snapper, sole, trout, tuna, swordfish, and whitefish) at 1:20 wt:vol (Bayer Allergy Products, Spokane, WA). All tests showed no reaction whatever except the swordfish, which elicited a 3-mm wheal and 5-mm erythema. Subsequent testing with fresh swordfish was also reactive (4-mm wheal and 8-mm erythema). A 1-mg/mL histamine control reacted at 4-mm wheal and 18-mm erythema, and a saline control gave no reaction.

Immunoassay for IgE antibodies was performed as previously de-

scribed<sup>4</sup> with results expressed as percent of negative control and values  $\geq 250\%$  considered positive. The same commercial swordfish extract that had been used for skin testing was negative at 141%; however, the fresh swordfish that had been used for skin testing was positive at 506% and an additional sample of cooked swordfish was also positive at 610%. Other commercial fish extracts (bass, cod, halibut, salmon, tuna, and whitefish) were also negative.

Protein immunoblotting for IgE antibody was performed as previously described.<sup>5</sup> Extracts of raw and cooked swordfish as well as cod, tuna, salmon, and whitefish were fractionated by electrophoresis in 12.5% acrylamide gels containing 1% sodium dodecyl-sulfate (SDS-PAGE), blotted onto nitrocellulose membranes, and probed with serum from the swordfish-allergic patient (Fig 1A). For comparison, immunoblots were also prepared using serum obtained from a patient who reported immediate allergic reactions to many different fish and who was skin test positive to all ten commercial extracts including swordfish (Fig 1B). As a negative control, immunoblots were prepared using serum from a subject reporting no allergic reaction to fish or any other food (Fig 1C). Immunoblots from all three subjects demonstrated binding to a number of high molecular weight components in tuna, salmon, and whitefish. This finding is nonspecific artifact, ie, due to direct binding of anti-IgE antibody to fish proteins, occurring in an identical pattern in all three subjects, including the one without clinical allergy. This nonspecific binding also occurred when the immunoblots were performed using 5% human serum albumin, umbilical cord serum, or no serum at all. This phenomenon has been observed in a previous study of fish allergens.<sup>3</sup> The multiple-fish allergic subject demonstrates

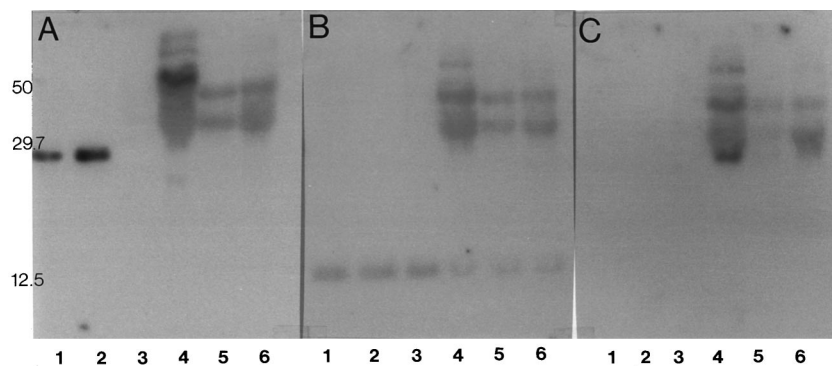


Figure 1. Protein immunoblot for IgE antibody using extracts made from: 1, raw swordfish; 2, cooked swordfish; 3, cod; 4, tuna; 5, salmon; 6, whitefish. Molecular weight markers in kilodaltons shown to left of figure. Serum from: (A) swordfish-allergic patient (note: ~25-kD bands to swordfish); (B) multiple fish-allergic patient (note: ~13-kD bands to all fish); (C) non-allergic control subject (note: artifact to high molecular weight components in some fish).

IgE antibody directed against an approximately 13-kD protein present in all of the fish including swordfish. This is probably Gad c 1 in cod and its analogue in the other fish. The exclusively swordfish-allergic subject showed IgE antibody only to a protein of approximately 25 kD in both raw and cooked swordfish.

## DISCUSSION

A previous study of 11 fish-allergic subjects examined skin test reactions to ten fish species, not including swordfish.<sup>3</sup> Most were skin test-positive to all ten species. When oral challenges were performed, however, most reacted to only one fish species. Most

of these subjects had IgE antibody directed against a 13-kD protein believed to be Gad c 1 or its analogue as in our multiple fish-allergic comparison subject. One subject in this previous report with positive skin tests to only two species (perch and trout) and clinical reactivity to only one (perch), lacked IgE antibody to the 13-kD protein. The authors speculated that "perhaps patients that are negative to Gad c 1 or its analogous protein in other fish species are especially likely to have species-specific fish allergy." Our patient, clinically allergic only to swordfish, would appear to confirm that notion. He had skin test and IgE immunoassay positivity only to swordfish, and his immunoblot

revealed IgE antibody directed only against a 25-kD protein in swordfish alone. It is interesting to note that swordfish (*Xiphias gladius*) is the only member of the Xiphiidae fish family, which may explain this unique allergen.

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