

Abstract

Rationale:

The possibility that cooking oils may absorb and transfer food allergens during deep frying could potentially present unintended allergen exposure to shrimp-allergic individuals. Our previous study demonstrated shrimp allergenic activity in oil used to fry raw shrimp. The following study addressed the issue of shrimp allergen transfer from raw breaded shrimp (RB-shrimp) to cooking oil.

Methods:

Increasing amounts of RB-shrimp were fried separately. Aqueous extracts of oil were prepared for analysis. Test material included extracts of control cooking oil (no shrimp frying), and oils in which 5 or 25 batches of RB-shrimp had been fried. All assays employed a pool of sera from 12 shrimp-allergic CAP RAST positive individuals, using the shrimp CAP RAST inhibition (inh) assay.

Results:

Shrimp extracts at 1, 10, to 100ug/ml inhibited shrimp CAP-RAST 65 to 78%. Whereas control oil extract was negative, oil in which RB-shrimp was fried 5 – 25X, yielded 40 - 60% inh; 25X shrimp fried oil extract (0.2, 2, and 20mg/ml inhibited 46, 55, and 60%. Monoclonal anti-Mite tropomyosin demonstrated significant shrimp tropomyosin in the shrimp-oil extract. Current studies are testing French fries, and breaded fish, chicken, and onion rings fried in 25X shrimp oil.

Conclusions:

These results demonstrate that shrimp allergenic activity can be detected in oil used to cook shrimp regardless of whether the shrimp was breaded or not; the greater number of shrimp batches fried, the greater the shrimp allergenic activity in the oil. A significant component transferred is shrimp tropomyosin, a major shrimp allergen. Further studies are being done to determine if shrimp allergens are transferred to non-allergenic foods fried

Introduction

Approximately 1.5% of adults and 5-6% of children have food allergies. Shellfish is one of the common food allergies and can result in severe reactions including death.

Eight foods or food groups account for ~90% of food allergies. Unintended exposure to these allergens poses a potentially avoidable risk for reactions in known allergic patients.

Our previous studies suggest that shrimp allergens may be present in oil used to deep fry shrimp and reusing such oil may transfer allergens to non-shrimp fried food. Thus cooking oil was investigated as a potential unrecognized

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Unintended Exposure to Shrimp Allergen: Studies of Cooking Oil used to Deep Fry Breaded Shrimp

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Methods

Raw breaded shrimp and other foods were fried in canola oil in a Waring Stir Pro Fryer for 3-5 minutes. Fried foods were then removed, cooled, and placed on paper towels to cool and remove excess oil (see Figure 1). Increasing amounts of Raw Breaded shrimp (RBS) were fried separately 5 or 25X.

Aqueous extracts of oil were prepared for analysis. Additional samples included extracts of control cooking oil (no shrimp frying), and oils in which batches of RBS were first fried followed by French fries, breaded fish, breaded chicken, or breaded onion rings.

All oils and food samples were extracted with saline, and stored at -20°C. Activity (% inhibition) was measured with sera pool (12 shrimp-allergic CAP RAST positive), using the shrimp CAP RAST inhibition (inh) assay. As a method of comparison, the net (experimental minus control) inhibition activity for each food was calculated and results expressed as % inhibition.

Components in oil extract were analyzed by western blot with monoclonal anti mite tropomyosin.

Net inhibition activity was used to estimate the equivalent amount of shrimp needed, using our standard shrimp inhibition curve. Using the shrimp equivalent amount, the total amount of shrimp in a seafood meal could be estimated.

Figure 1



Fig. 2 Shrimp Allergens in Fried Foods & Cooking Oil

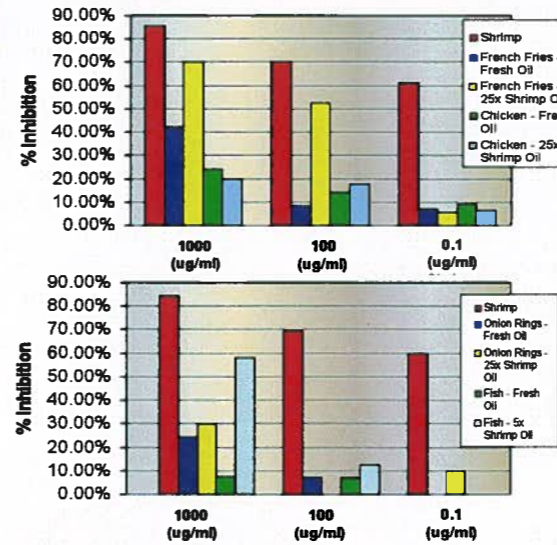


Fig. 3 Analysis of Shrimp Oil Extract by Western Blot



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1) Tropomyosin control (2) 25X shrimp Oil

Table 1. Estimated Amounts of Shrimp Allergen

Sample	Net Activity	Estimated Amount
French Fries	40.5% at 5.62 mb/ml	37.37 ug
Fish	52.1% at 2.35 mg/ml	10.6 ug
Chicken	No Activity	0
Onion rings	18.0% at 30.0 mg/ml	0.278 ug



References

- Daul et al, Provocation-challenge studies in shrimp-sensitive individuals, J Allergy Clin Immunol. 1988 Jun;81(6):1180-6.
- (FDA Consumer Magazine, July-August 2001 Issue, Pub No. FDA

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Results

- Shrimp extracts at 1, 10, to 100ug/ml inhibited shrimp CAP-RAST 65 to 78%.
- Control oil extract was negative (see Figure 2).
- Oil in which RB-shrimp was fried 5 – 25X, yielded 40 - 60% inh; 25X shrimp fried oil extract (0.2, 2, and 20mg/ml inhibited 46, 55, and 60%.
- Monoclonal anti-Mite tropomyosin demonstrated significant shrimp tropomyosin in the shrimp-oil extract (see Figure 3).

Conclusion

- Beta-2 Shrimp allergenic activity can be detected in oil used to fry shrimp regardless of whether the shrimp was breaded or not.
- The greater number of shrimp batches fried, the greater the shrimp allergenic activity of the oil.
- A significant component transferred is the major shrimp allergen, tropomyosin.
- A plated amount of fish, onion rings and French fries (pictured below) was estimated to contain approximately 50 µg of shrimp equivalent (Table 1) which is 640 fold less (based on challenge studies) than that estimated to induce an allergic reaction due to exposure (1).
- Thus exposure to shrimp allergen via transfer from cooking oil to other non shrimp containing foods does occur,
- Although it is unlikely to be a major cause of clinically significant reactions, further studies are required.