
Dust-mite allergen removal from feathers by commercial processing

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Background: Individuals with allergies or asthma have had a long-standing bias against the use of chicken, goose, and duck feather pillows, comforters, quilts, and mattresses.

Objective: We show that raw, unprocessed feathers contain dust-mite allergen that is removed by washing, and that feather pillows, whether covered or not, do not internally accumulate dust-mite allergen when used in mite-infested bedrooms over a 3-month period.

Methods: Feathers obtained from six companies as unprocessed feathers ($n = 8$ batches) and processed feathers ($n = 16$ batches) were analyzed for dust-mite (Der p 1 and Der f 1) using monoclonal antibody-based immunoassays with appropriate internal controls. Five pairs of new feather pillows (one covered and one uncovered) were placed in five bedrooms with known dust-mite contamination for 90 days. The pillows were then assayed for mite content.

Results: Dust-mite allergen was detected in 7 of 8 unprocessed feather samples; combined Der p 1 and Der f 1 mean = 524 ng/g, range 152 to 1,850 ng/g, whereas all 17 manufacturer-processed feather samples contained no detectable dust-mite. Although 4 of 5 bedrooms contained significant dust-mite allergen ($>2,000$ ng or Der p 1 and f 1, range 2,500 to 10,300 ng/g), none of the 90-day feather pillows became contaminated by dust-mite allergen even in the absence of a pillow cover.

Conclusions: Feathers washed using industrial methods do not contain detectable dust-mite allergen. Pillows manufactured with processed feathers, whether encased in a dust cover or not, do not become contaminated by dust-mite allergen after 90 days of use in environments containing significant dust-mite allergen contamination.

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INTRODUCTION

Individuals with allergies or asthma have had a long-standing bias against the use of chicken, goose, and duck feather pillows, comforters, quilts, and mattresses.¹ This opinion has resulted from a perceived concern that feather-based products are breeding sites for dust mites and traps for mold, pet epidermal, and other indoor allergens. To date, there has been no systematic study examining the hypotheses that

dust-mite allergen is present in unprocessed feathers and that standard manufacturing processes (eg, washing, drying, and sanitizing) eliminate mite allergen contamination from the feathers before their insertion into finished products. In this study, we show that unprocessed feathers contain dust-mite allergen that is removed by washing. We further show that feather pillows, whether covered or not, do not internally accumulate dust-mite allergen when used in mite-infested bedrooms over a 3-month period.

METHODS

Feathers were obtained from six companies (Pacific Coast Feather Company, Seattle, WA; California Feather and Down, Lynwood, CA; Down Inc, Grand Rapids, MI; Hollander, Boca

Raton, FL; Pillowtex, Kannapolis, NC; and United Feather and Down, Des Plaines, IL) as; raw, unprocessed feathers ($n = 8$ batches) and processed feathers ($n = 16$ batches). All feather samples were coded by A.D. and sent masked to the Johns Hopkins Dermatology, Allergy, and Clinical Immunology (DACI) Reference Laboratory where they were accessioned and stored at 23° C until extracted and analyzed. Duplicate 2-g samples of each feather batch were collected from the top and bottom of each batch sample. A 500-mg aliquot of each feather sample was extracted after 16 hours with rotation at 23° C using 10 mL of borate-buffered saline containing 5% bovine serum albumin. After extraction, each feather-extract mixture was poured into a 60-mL plastic syringe equipped with a 0.2- μ m filter (Millipore, Bedford, MA) and sterile-filtered by reinserting the plunger and squeezing fluid from the feathers. All extracts were analyzed for dust-mite allergen (Der p 1 and Der f 1) using monoclonal antibody-based immunoassays with appropriate internal controls.²

Five New York City volunteers participated with informed consent in the allergen transfer study in late summer and autumn. Each bedroom was vacuumed with a sock dust collector (DuPont Hytech, 1 μ m exclusion) mounted on common household vacuums. Dust samples were collected from the surface of the bed, adjacent floor, and upholstered furniture in the bedroom. All dust specimens were sent coded to the Johns Hopkins DACI Laboratory where they were sieved, extracted (2 mL of borate-buffered saline/100 mg of fine dust), and analyzed for Der p 1 and Der f 1 content. Feathers from five pairs of new pillows (Pacific Coast Feather Company) were

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preassayed for Der p 1 and Der f 1 content. One of each pair was covered with an Allergy Control cover (Ridgefield, CT) and the 5 pairs of pillows were placed on beds in five test bedrooms containing dust-mite allergen for a 90-day study period. After the 90 days, the feather contents of the pillows were removed and assayed for mite content by monoclonal antibody-based immunoassay assays.

RESULTS

Dust-mite allergen was detected in 7 of 8 raw, unprocessed feather samples: mean combined Der p 1 and Der f 1 = 524 ng/g, range = 152 to 1,850 ng/g (average allergen concentration, top + bottom of bag). All 16 feather samples that had been processed by a manufacturer (eg, washed repetitively in hot water using a nonionic, neutral pH soap, dried, and sanitized) and those from the new pillows contained no detectable Der p 1 or Der f 1 allergen (<20 ng/g).

In the allergen transfer study, all five bedroom environments evaluated in this study contained detectable allergen. Only four bedrooms had significant allergen (>2,000 ng of Der p 1 or Der f 1, range 2,500 to 10,300 ng/g). None of the pre- or 90-day pillows had feathers that contained any detectable dust-mite allergen.

DISCUSSION

Recommended avoidance of feather-filled products by allergy and asthma patients is long-standing but it has recently faltered under scientific scrutiny. Three studies (2 in New Zealand, 1 in Great Britain) have observed that synthetic pillows accumulate dust-mite allergen at a rate faster than feather pillows,³ and that synthetic materials contain a higher concentration of dust-mite allergen after a given period of use.³⁻⁵ All three studies suggest that the tightly woven feather-proof encasing may be more dust-mite allergen-proof than more loosely woven covers used on synthetic pillows.

In contrast to previous studies, we examined un-encased feather samples, before processing, preuse, and postuse, rather than vacuum dust samples taken from intact pillows. We found that although raw-unprocessed feathers can contain modest levels of dust-mite allergen, feather-processing techniques that involve washing and drying remove all detectable dust-mite allergen. Contrary to the observations of Rains et al,³ we found that at zero months, feathers from pillows did not contain detectable dust-mite allergen. Similar to Rains et al, we observed that after 90 days, whether encased with a dust cover or not, feathers from pillows used in a limited number of bedrooms with dust-mite allergen levels >2,000 ng/g did not become contaminated

with dust-mite allergen. The duration of our pilot study was limited to 90 days, and future studies should examine the possibility of contamination longitudinally. These data suggest that the long-accepted medical advice of feather pillow avoidance by dust-mite allergic children be reconsidered.

REFERENCES

1. Strachan DP, Carey IM. Home environment and severe asthma in adolescence: a population based case-control study. *BMJ* 1995;311:1053-1056.
2. Hamilton RG, Chapman MD, Platts-Mills TA, Adkinson NF Jr. House dust aeroallergen measurements in clinical practice. *Immunol Allergy Pract* 1992;14:96-112.
3. Rains N, Siebers R, Crane J, Fitzharris P. House dust-mite allergen (Der p 1) accumulation on new synthetic and feather pillows. *Clin Exp Allergy* 1999;29:182-185.
4. Hallam C, Custovic A, Simpson B, et al. Mite allergens in feather and synthetic pillows. *Allergy* 1999;54:401-408.
5. Kemp TJ, Siebers RW, Fishwick D, et al. House dust mite allergen in pillows. *BMJ* 1996;313:916.

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