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Massive Exposure to Aeroallergens in Dairy Farming: Radioimmunoassay Results of Dust Collection During Bedding Chopping With Culture Confirmation

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Previous studies have shown that barn dust contains a wide variety of aeroallergens [Donham, 1986; Malmberg et al., 1985]. Certain farm tasks exposed workers to high levels of these substance. One such task involves providing chopped bedding for cattle stalls. Using an internal combustion motor, a mechanical device cuts up bales of hay or straw and blows the chopped bedding material into stalls. This work activity generates a good deal of dust. Farmers often complain about the work environment associated with this task.

In order to study the nature of the exposure that occurs in mechanical bedding chopping, we undertook an air sampling study. We chose to study three common, serious aeroallergens: *Thermoactinomyces vulgaris* (TV), *Micropolyspora faeni* (MF), and *Aspergillus fumigatus (AF)*. Separate dust samples were collected prior to, during, and immediately after use of the chopper. Barn ventilation was that of winter conditions. The collection periods were for 20–60 minutes. We used 0.3 μm filters, in air pumps filtering at 3 liters/second (Quan-Ted-Air, Inc., Minneapolis, MN). After collection, dust samples were eluted in a 0.1 M phosphate buffer, 0.2% BSA, and 50% glycerol. Pooled antibody was obtained from patients with IgG against TV, MF, and AF.

Radioimmunoassay inhibition analysis was done using the microtiter plate procedure [Swanson et al., 1987]. Results (Table I) show that there was a highly significant rise in all aeroallergens during bedding chopper use. Allergen levels fell rapidly after the task was completed.

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TABLE I. Mean Aeroallergens Levels in ng/m^3 for Ten Barns Near Cooperstown, New York, Before, During, and After Bedding Chopper Operation (Natural Log Conversion)

	Before	During[a]	After
A. fumigatus	1,015	72,101	2,429
T. vulgaris	107	3,772	128
M. faeni	121	3,147	141

[a]Significantly different from before and after reading ($p<0.001$).

TABLE II. Mean Number of Colonies/m^3 of Mesophilic Fungi Collected by All Glass Impingers From Four Barns Near Cooperstown, New York, Before, During, and After Bedding Chopper Operation (Nautral Log Conversion)

	A. fumigatus
Before	9,600
During[a]	1,083,900
After	30,000

[a]$p<0.01$.

The allergen rise was significant during bedding chopper operation at the $p<0.001$ level for AF, MF, and at the 0.01 for TV (paired t test). The pre- and post-difference trended higher but was not significantly different.

The results for AF were confirmed on four farms by independently collected samples using all glass impingers and culture media (rose-bengal and streptomycin) for mesophilic fungi.

The rise in colonies of mesophilic fungi was highly significant during the chopper operation ($p<0.01$, by paired t test). The pre- and post-level comparisons also trended higher but were not significantly different (Table II).

Our results show that dairy farmers using bedding choppers are exposed to massive levels of potentially hazardous aeroallergens. Scant prior data are available for MF and TV, but AF has been studied. The highest previously recorded level of AF was 25 ng/m^3, nearly three logs lower than our mean "during" measurement [Mulhausen et al., 1987]. Very moldy houses measure 5 ng/m^3. The culture studies confirm massive rises in viable mesophilic fungi. The potential for allergic alveolitis and allergic aspergillosis would seem to be greatly increased by the use of this device without proper ventilation and/or personal protective equipment. Further studies are needed to confirm our results and identify other barn aeroallergens.

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