

Hot tumble drying and mite survival in duvets

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Exposure to the house dust mite (HDM) allergen Der p 1 has increasingly been associated with the development and exacerbation of asthma. Consequently, HDM allergen avoidance advice is included in management plans for asthma and allergic diseases. A particular focus is placed on the bedroom, where HDM allergen exposures are usually highest.¹ Occlusive covers for mattresses, duvets, and pillows are effective in reducing exposure to reservoir HDM allergen, and hot-water washing (>55°C) is effective in killing HDMs. Unfortunately, many patients are unable to afford allergen control covers for bedding, and hot-water washing is not always practical.

It has recently been shown that the use of a domestic clothes dryer is effective in killing mites in one type of blanket.² In that study, strips of blankets were inoculated with HDMs before being tumble dried in a domestic clothes dryer. Because synthetic duvets (comforters) are widely used as bedding in New Zealand, an environment with high HDM allergen levels in the bedroom,³ we have investigated whether tumble drying of the whole duvet is effective in killing HDMs, removing allergen, or both.

METHODS

Eight synthetic material-filled double and queen-sized duvets were studied. Each had been present on a bed and not washed or dry-cleaned for at least 6 weeks. Loose duvet covers were removed. A dust sample was collected from one corner of the duvet by vacuuming a 0.5 m² area for 2 minutes with a Hitachi 1000 W vacuum cleaner, with a nylon collection bag inserted onto the vacuum head. Live HDM numbers were then estimated by the heat escape method⁴ from a different corner of the duvet. Eleven 50 × 1.9 cm strips of adhesive tape (total area, 0.105 m²) were applied to the underside of the duvet, and heat was directed at the opposite side for 2 hours with a 250 W heat lamp suspended 35 cm above the site. Live and dead mites were then counted on the adhesive tape under 20× stereo magnification. Mites were considered live if full bodied

Abbreviation used

HDM: House dust mite

and moving and dead if not active, even when touched with a blunt probe.

Each duvet was then individually tumble dried for 1 hour on the maximum setting in a domestic clothes dryer (Simpson Maxidry 457, 1800 W). A data-logging device (ACR Smart Reader 2) was placed in the center of the duvet, and temperature and relative humidity were recorded at 8-second intervals. After the heating period, the duvet was placed in a humid environment for approximately 20 hours to allow any live but stunned mites to recover. Live HDMs were then again assessed by heat escape, and dust was collected from the opposing corners of the duvet.

Dust was fine sieved (425 µm) and extracted in room temperature PBS. Der p 1 was measured by established double-mAb ELISA.³ Statistical analysis was done with the Mann-Whitney *U* test.

RESULTS

The duvets were found to contain substantial numbers of mites, with a mean of 410/m² (range, 38 to 1229/m²) sampled. These numbers were significantly reduced to 6/m² (range, 0 to 38/m²) after hot tumble drying (*P* = .0007, Table I). Mean Der p 1 concentration (in micrograms per gram), however, was not significantly affected by tumble-drying (*P* = .92), and there was no significant alteration to mean sampled dust weight after tumble-drying (0.12 g before [range, 0.0035 to 0.2649 g] and 0.11 g after [range, 0.004 to 0.2004 g]). All duvets contained greater than 10 µg/g Der p 1, with 4 containing greater than 100 µg/g.

The probe identified a mean maximum temperature of 59.3°C (range, 51.8°C to 65.8°C), with a relative humidity of less than 10% (limit of the Smart Reader) during the 1-hour drying period. The mean time to reach 55°C, the thermal death point of *Dermatophagoides pteronyssinus*,⁵ was 22 minutes (range, 11 to 42 minutes). The mean time to reach 10% humidity was 5.7 minutes (range, 4 to 9 minutes).

DISCUSSION

This study confirms that duvets are a potential source of high concentrations of HDM allergens and demonstrates that the use of a domestic dryer could be an additional easy and effective method of HDM avoidance. Although the great majority of mites were killed in the

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TABLE I. The effect of hot tumble drying for 1 hour on live mite numbers and Der p 1 levels in duvets

Duvet	No. of live mites (0.105 m ² sampled)		Der p 1 (μg/g)	
	Before dryer	After dryer	Before dryer	After dryer
1	23	1	361.0	347.3
2	4	0	46.2	100.0
3	129	4	184.4	165.2
4	22	0	71.5	89.4
5	29	0	390.0	520.9
6	87	0	122.1	96.1
7	18	0	67.3	49.3
8	33	0	58.7	55.1
Mean	43.1	0.6	119.4	127.5
95% CI	7.6-78.6	-0.6-1.8	59.7-238.9	63.2-257.0

CI, Confidence interval.

dryer, neither Der p 1 concentrations in duvet dust samples nor total dust weights were significantly altered by tumble drying. In this study dry duvets were used. Further studies would be needed to determine the effects when starting with a washed wet duvet and to assess the minimum necessary time and/or temperature to kill HDMs in a domestic dryer. Material type and thickness

may have an effect on maximum temperature reached, possibly influencing the killing of HDMs, and it is not yet known whether this method will be effective on thicker bedding materials, such as pillows.

This study supports previous findings² that dryers were effective in killing HDMs inoculated into strips of Vellux and Snuggable brand blankets. It extends the findings to whole duvets infested with high mite numbers and allergen levels in a normal household situation. Cold water washing of duvets will substantially reduce allergen but will not kill mites. Prolonged hot tumble drying represents a convenient way of destroying mites in this type of bedding.

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