

Mites in dust samples from mattress surfaces from single beds or cribs in the south Brazilian city of Londrina

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The aim of this study was to investigate the mite fauna in mattresses dust samples from cribs or beds in the south Brazilian city of Londrina, State of Paraná. A total of 133 dust samples from upper and lower mattress surfaces, and bed frames were aspirated once from 38 dwellings (18 cribs and 21 beds), and one day nursery (six cribs). A total of 758 mite bodies were counted in slides: 233 (30.7%) from cribs and 525 (69.3%) from beds ($p < 0.001$). House dust mites – mainly *Dermatophagoides pteronyssinus*, represented 72% and 84% of total mite count in crib and bed dust samples, respectively. The mean HDM body concentration in crib or bed slides were, respectively, 289.9 ± 136.7 and 875.0 ± 183.6 mites/g. Statistical analysis showed a significantly higher mite bodies count on lower mattress surface compared with upper surface in bed samples only ($p = 0.025$). Data herein show that cribs like mattress have sufficient mite bodies to cause sensitization to humans. The use of mattress covers for cribs and beds should be encouraged in order to avoid allergens exposure.

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Mattresses have been considered the most important source of house dust mite (HDM) allergens for humans (1, 2). In Brazil, in addition to mattresses, HDM and storage mites are frequently found in pillows, sofas, rugs, and carpets (3, 4).

Previous studies have shown a significant increase of HDM allergen content or mite body count on mattress lower surface, and/or mattress base, compared with the upper mattress surface (5, 6). Based on this information, we decided to count and classify the different mite species in dust samples from upper or lower mattress surfaces from cribs and beds, in addition to bed frames from different dwellings and a day nursery in Londrina, State of Paraná, a Brazilian subtropical city.

Material and methods

Samples were collected once from each upper and lower mattress surfaces, and from bed frames, from a total of 24 cribs and 21 beds of

patients with symptoms of asthma and/or rhinitis in the south Brazilian city of Londrina (51°10' W, 23°33' S; 576 m above sea level; 21.4°C mean annual temperature). The volunteers (children under 7-yr-old and adults) were recruited from medical appointments at the Clinic of Allergy in State University of Londrina.

Thirty-eight dwellings (total of 18 cribs and 21 beds) and day nursery (six cribs) were selected after volunteers written informed consent. The procedures were approved by the Ethics Committee of State University of Campinas Medical School. A total of 133 samples were collected between September 2001 and January 2002. Each surface was vacuumed for 2 min (covering approximately 1 m²) with a 1000-W vacuum cleaner (Electrolux®, Curitiba, Brazil). A piece of fine linen cambric (10 × 10 cm), placed over the distal opening of the suction hose with the cleaning nozzle, trapped the aspirated dust. When a mattress cover was present, the cover sheet was removed before sampling. The larger particles in each dust sample were removed by

sieving through a fine-mesh (500 μm) sieve. The fine dust passed through the sieve was weighed, cleared and mounted in Hoyer's medium before identification of the larvae, nymphs and adults (body count) under a light microscope. The number of mites per slide was then extrapolated for 1 g of dust using a previously standardized correlation factor (7). Statistical analysis was performed using the Kruskal–Wallis, Mann–Whitney and Wilcoxon non-parametric tests. The significance level was 5%.

Results

A total of 758 mite bodies were counted in the 133 slides: 525 (69.3%) in bed and 233 (30.7%) in crib slides ($p = 0.0003$; Mann–Whitney test). Furthermore, a significant difference was also observed in mite body count between each crib and bed dust collection places [Table 1]. All mite life stages (eggs, larvae, nymphs and adults) were observed.

The estimated mite body concentration (mean $\pm$ 95% CI) in bed and crib samples were 1075.8 ± 198.8 mites per gram of fine dust (mites/g) and 404.5 ± 183.3 mites/g, respectively. The mean mite body concentration on the mattress upper surface was 359.4 ± 311.5 and 779.8 ± 251.3 mites/g in crib and bed samples, respectively.

A total of 608 HDM bodies (Pyroglyphidae mites) were found, significantly higher in bed slides (441; 72.5%) than in crib slides ($p < 0.0001$; Mann–Whitney test). According to this, the mean HDM body concentration in crib and bed slides were 289.9 ± 136.7 and 875.0 ± 183.6 mites/g, respectively. Tables 2 and 3 present the final data in crib and bed dust slides, respectively. A detailed analysis of the Pyroglyphidae mites showed that the *Dermatophagoides* genus and the *Dermatophagoides pteronyssinus* species were the most frequently mite counted.

Table 1. Total mite bodies count in slides from 72 crib and 61 bed dust samples from 38 dwellings and a day nursery in Londrina, Brazil

	Crib		Bed		p-Value
	n	%	n	%	
US	69	29.6	131	25.0	0.0017
LS	90	38.6	215	40.9	0.0002
Bed frame	74	31.8	179	34.1	0.0002
Total	233	100.0	525	100.0	0.0003

n, total number of mites; US, upper mattress surface; LS, lower mattress surface; p-value, statistical p-value using Mann–Whitney test.

In addition to HDM, other fewer observed families in both crib and bed samples were Cheyletidae, Tarsonemidae, and Glycyphagidae. These families represented 7.6% ($n = 40$), 2.3% ($n = 12$), and 1.9% ($n = 10$) of total mite bodies found in bed dust slides, and 7.7% ($n = 18$), 3.4% ($n = 8$), and 9.4% ($n = 22$) in crib dust slides, respectively.

No significant differences were observed concerning the number of mites in the different bed and crib places of dust collection, but mite count on mattress lower surface from beds that was significantly higher than on upper surface ($p = 0.025$; Wilcoxon test).

Cribs, beds, and bed frames were made from wood. Mattresses were made from polyurethane foam. Approximately 65% of crib and bed mattresses and pillows had less than 5 yr of use. No statistical differences were observed concerning mattresses, pillows or even crib/bed using ages. Also, the use of mattress covers on cribs (six; 25% of crib samples) and beds (three; 14%) showed no significant mite body count change. None of the covers were zipped or had an internal plastic layer. The covers were made from cotton (78%) and only one cover was considered adequate to protect against mattress mite infestation (polyester-made zipped cover with an internal plastic layer).

Other variables like smoking, family income, and adult education level showed no significant difference between crib and bed mite body count. Furthermore, when mite count in crib dust samples from dwellings and the day nursery were compared, no significant difference was observed.

Discussion

This study confirms the presence of mites in dust samples from bed lower mattress surface and bed frames and shows that this fact also occurs in cribs dust samples (5, 6). Pauli et al. (1997) described a significant increase in the Der p1 and Der f1 allergens levels on bed basement ($p < 0.00008$), with a mean of $48.3 \mu\text{g/g}$ (or approximately 2415 mites/g). Apparently, this fact could be related to the deposition of these allergens on mattresses along the time (5).

Another study investigated the number of mite bodies in dust from the same sites of bed mattresses showed that the lower mattress surface was also infested by mites (6). The authors showed a significant increase in the number of total mite bodies in dust samples from upper and lower (in the last, also included bed frame) mattress surfaces when compared to other indoor

Table 2. Total mite bodies count in slides from 72 crib dust samples from 17 dwellings and a day nursery in Londrina, Brazil

Cribs	US (n = 24)		LS (n = 24)		BF (n = 24)		Total (n = 72)	
	n	%	n	%	n	%	n	%
Suborder Acaridida	59	85.5	68	75.6	64	86.5	191	82.0
Family Pyroglyphidae	51	73.9	60	66.7	56	75.7	167	71.7
Larvae	11	15.9	18	20.0	6	8.1	35	15.0
<i>Dermatophagoides</i> nymphs	13	18.8	18	20.0	15	20.3	46	19.7
<i>Dermatophagoides pteronyssinus</i>	15	21.7	15	16.7	19	25.7	49	21.0
<i>Dermatophagoides farinae</i>	1	1.4	2	2.2	3	4.1	6	2.6
<i>Euroglyphus maynei</i>	10	14.5	6	6.7	13	17.6	29	12.4
<i>Pyroglyphus africanus</i>	1	1.4	1	1.1	0	0.0	2	0.9
Family Glycyphagidae	8	11.6	7	7.8	7	9.5	22	9.4
Larvae	1	1.4	2	2.2	1	1.4	4	1.7
<i>Blomia tropicalis</i>	5	7.2	5	5.6	5	6.8	15	6.4
<i>Chortoglyphus arcuatus</i>	1	1.4	0	0.0	0	0.0	1	0.4
Not identified	1	1.4	0	0.0	1	1.4	2	0.9
Family Acaridae	0	0.0	1	1.1	1	1.4	2	0.9
Larvae	0	0.0	1	1.1	0	0.0	1	0.4
<i>Tyrophagus putrescentiae</i>	0	0.0	0	0.0	1	1.4	1	0.4
Suborder Actinedida	7	10.1	15	16.7	9	12.2	31	13.3
Family Cheyletidae	4	5.8	8	8.9	6	8.1	18	7.7
Family Tarsonemidae	2	2.9	5	5.6	1	1.4	8	3.4
<i>Tarsonemus</i> sp.	0	0.0	4	4.4	1	1.4	5	2.1
<i>Tarsonemoides</i> sp.	1	1.4	1	1.1	0	0.0	2	0.9
Not identified	1	1.4	0	0.0	0	0.0	1	0.4
Family Pyemotidae	0	0.0	2	2.2	1	1.4	3	1.3
Family Demodicidae	1	1.4	0	0.0	0	0.0	1	0.4
Family not identified	0	0.0	0	0.0	1	1.4	1	0.4
Suborder Oribatida	1	1.4	6	6.7	1	1.4	8	3.4
Family not identified	1	1.4	6	6.7	1	1.4	8	3.4
Suborder Gamasida	1	1.4	1	1.1	0	0.0	2	0.9
Family not identified	1	1.4	1	1.1	0	0.0	2	0.9
Other mites (Suborder not identified)	1	1.4	0	0.0	0	0.0	1	0.4
Total of mites	69	100.0	90	100.0	74	100.0	233	100.0

US, upper mattress surface; LS, lower mattress surface; BF, bed frame.

sources ($p < 0.0001$). Similarly, the number of HDM was also significantly higher on lower surface ($p < 0.0001$) (6).

Pyroglyphidae mites – mainly *D. pteronyssinus* – were the most prevalent mites in our samples. In addition, the presence of eggs, larvae, nymphs, and adults confirms mite adaptation and reproduction at these sites. Based on the number of HDM bodies in this study, we can indirectly estimate total Der p1 content in cribs and beds dust samplings as 5.8 ± 2.7 and 17.5 ± 3.7 $\mu\text{g/g}$, respectively (1).

Besides HDM, mite bodies of the families Cheyletidae (predators), Tarsonemidae (glistening mites), and Glycyphagidae (storage mites) were also observed. However, the observed prevalence of these mites were quite lower than that observed of HDM. Storage mites showed a lower prevalence in Londrina than in other Brazilian tropical areas (3, 4). The south Brazilian city of Londrina is known to have a subtropical climate (the limit to temperate

climate) with 21.1°C of mean annual temperature and high air humidity (68%), which should influence mite fauna in indoor dust.

The present study found some similarity in the evaluation of mite species in dust samples collected from different cribs and beds sources. Interestingly, in both cribs and beds samples the lowest and the highest mite body concentrations were observed on the upper and on the lower surfaces of mattresses, respectively. A possible and partial explanation to this fact can be the darkness and ‘safeness’ at the lower mattress surface and crib/bed frame.

The gold standard method to measure mite allergens content is the enzymatic immunoassay (1, 8, 9). However, only few mite allergen extracts are currently available for immunoassays, mainly *D. pteronyssinus*, *Dermatophagoides farinae*, and *Blomia tropicalis*. Considering that the number of different mite species in indoor dust samples from tropical areas are frequently high, the number of mite bodies of several other commonly

Table 3. Total mite bodies count in slides from 61 bed dust samples from 21 dwellings in Londrina, Brazil

Beds	US (n = 21)		LS (n = 20)		BF (n = 20)		Total (n = 61)	
	n	%	n	%	n	%	n	%
Suborder Acaridida	116	88.6	197	91.6	149	83.2	462	88.0
Family Pyroglyphidae	115	87.8	188	87.4	138	77.1	441	84.0
Larvae	25	19.1	56	26.0	27	15.1	108	20.6
<i>Dermatophagoides nymphs</i>	27	20.6	56	26.0	39	21.8	122	23.2
<i>Dermatophagoides pteronyssinus</i>	39	29.8	37	17.2	44	24.6	120	22.9
<i>Dermatophagoides farinae</i>	5	3.8	13	6.0	17	9.5	35	6.7
<i>Euroglyphus maynei</i>	16	12.2	26	12.1	9	5.0	51	9.7
<i>Pyroglyphus africanus</i>	3	2.3	0	0.0	2	1.1	5	1.0
Family Glycyphagidae	0	0.0	3	1.4	7	3.9	10	1.9
<i>Blomia tropicalis</i>	0	0.0	3	1.4	7	3.9	10	1.9
Family Acaridae	1	0.8	6	2.8	3	1.7	10	1.9
Larvae	0	0.0	2	0.9	0	0.0	2	0.4
<i>Tyrophagus putrescentiae</i>	1	0.8	3	1.4	3	1.7	7	1.3
<i>Suidasia pontificiae</i>	0	0.0	1	0.5	0	0.0	1	0.2
Family not identified	0	0.0	0	0.0	1	0.6	1	0.2
Suborder Actinedida	13	9.9	17	7.9	28	15.6	58	11.0
Family Cheyletidae	8	6.1	12	5.6	20	11.2	40	7.6
Family Tarsonemidae	4	3.1	3	1.4	5	2.8	12	2.3
<i>Tarsonemus</i> sp.	3	2.3	3	1.4	5	2.8	11	2.1
<i>Tarsonemoides</i> sp.	1	0.8	0	0.0	0	0.0	1	0.2
Family Demodicidae	1	0.8	2	0.9	1	0.6	4	0.8
Family Eriophyidae	0	0.0	0	0.0	1	0.6	1	0.2
Family not identified	0	0.0	0	0.0	1	0.6	1	0.2
Suborder Oribatida	0	0.0	0	0.0	1	0.6	1	0.2
Family not identified	0	0.0	0	0.0	1	0.6	1	0.2
Suborder Gamasida	0	0.0	0	0.0	1	0.6	1	0.2
Family not identified	0	0.0	0	0.0	1	0.6	1	0.2
Other mites (not identified)	2	1.5	1	0.5	0	0.0	3	0.6
Total of mites	131	100.0	215	100.0	179	100.0	525	100.0

US, upper mattress surface; LS, lower mattress surface; BF, bed frame.

observed mite species include *Tyrophagus putrescentiae*, *Tarsonemus* spp. and *Cheyletus* spp., which can be currently analyzed only by optical microscopy.

This study analyzed mite fauna in dust samples from beds or cribs of atopic individuals. More studies are necessary to evaluate if there are many differences in mite content from bed/cribs of atopic and non-atopic individuals. In addition, our data shows that lower mattress surface plus bed frame should be more carefully studied and that some actions should be taken to avoid allergen increase on mattress. These actions should include the use of covers that fully isolate bed as much as crib mattresses.

Conclusion

Our results show that cribs and mattress have sufficient mite bodies to cause sensitization to humans. Mite allergens avoidance by using covers, for example, should be adopted in both crib and bed mattresses, in addition to cleaning of bed frames.

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