

Storage mite allergy among bakers

P. REVSBECH & M. DUEHOLM

Chest Clinic, Department of Respiratory Diseases, Aalborg Hospital, Denmark

Allergy to storage mites has been shown among farmers and grain elevator workers. This study aimed to examine whether bakers also are sensitized to storage mites. Twenty-three bakers or other employees in bakeries suffering from nasal or pulmonary symptoms were compared with 17 control persons with no relation to bakery work or agriculture. All participants underwent skin prick test with a standard panel of allergens, four types of flour and the storage mites *Acarus siro*, *Lepidoglyphus destructor* and *Tyrophagus putrescentiae*, RAST to storage mites and flour, and measurement of total IgE. We found no difference between the baker group and the control group in prevalence and strength of positive skin prick test or RAST to any of the three storage mite species. In the baker group positive RAST to flour was related to positive RAST to *A. siro* and *L. destructor*, but not *T. putrescentiae*. Almost all bakers sensitized to flour were also sensitized to storage mites (6 of 7). We suggest that if a baker become sensitized to flour he will be more prone to develop specific IgE towards storage mites too.

Key words: allergy; bakers; flour; storage mites.

The term storage mites is the ordinary name for a variety of non-pyroglyphid mites, comprising the genera *Acarus*, *Lepidoglyphus*, *Tyrophagus* and *Glycyphagus*. These four genera are often encountered in ecological studies of hay, straw, grain and other vegetable products. Occasionally, storage mites live in ordinary house dust, especially in damp houses. Allergy to storage mites in the form of bronchial asthma and allergic rhinitis has been shown among farmers in Scotland, Sweden and Denmark (2, 3, 5), but also among grain elevator workers in Denmark and Canada (7, 11).

This study examined among bakers, an occupation related to grain processing, the frequency of sensitization to storage mites and its relation to flour allergy.

MATERIAL AND METHODS

Twenty-three bakers or other employees in bakeries were compared with 17 control persons with no relation to bakery work or agriculture.

All in the baker group suffered from nasal or pulmonary symptoms and all indicated some or exclusive relation to their occupational environment. On suspicion of flour allergy all had undergone tests for allergy during the period 1 January 1983 to 30 June 1988. The control group was recruited among consecutive patients with respiratory symptoms referred to the allergy clinic. Data on the participants are given in Table 1.

In the baker group, the median length of employment was 6 years (range: 1-37 years). Seven were ex-bakers who had left employment 3 months to 3 years previously.

All participants gave informed consent and the protocol was approved by the local ethics committee.

All participants underwent the following tests:

1. Measurement of serum total IgE (PRIST, Pharmacia).

Table 1
Background data on the participants

	Baker group <i>n</i> = 23	Control group <i>n</i> = 17	<i>P</i>
Job category	Skilled baker: 10 Ex-baker: 7 Baker apprentice: 2 Shop assistant: 4	- - - -	
Age median (years) range	26 16-63	34 20-61	NS
Sex male female	17 6	9 8	NS
Rhinitis symptoms Pulmonary symptoms Both	11 8 4	4 10 3	} NS

2. Skin prick test (SPT) with a) a standard panel of allergen extracts (birch, timothy and mugwort pollen, horse, dog and cat dander, *Dermatophagoides pteronyssinus*, *D. farinae*, *Alternaria tenuis* and *Cladosporium herbarum*) in the concentration 10 HEP (*Alternaria* and *Cladosporium* 1:20 w/v), b) extracts (dialysed and glycerinized) of three storage mites (*Acarus siro*, *Lepidoglyphus destructor* and *Tyrophagus putrescentiae*) in concentration 10,000 Noon Equivalents per ml (NE/ml), c) extracts of four types of flour (wheat, rye, oats, barley), soya and yeast, in concentrations 1:20 w/v. The extracts were supplied by ALK-laboratories, Copenhagen (Soluprick®). Histamine 10 mg/ml was used as a positive control. Positive reactions were measured in mm² and graded according to the histamine control (1).

Table 2

Relation between RAST to flour and RAST to storage mites (3 species) in the baker group. The RAST scores for the storage mites are given in PRU's and as median values

	RAST to flour		<i>P</i>
	pos.	neg.	
	(<i>n</i> = 7)	(<i>n</i> = 16)	
RAST to <i>A. siro</i>	5	1	< 0.01
RAST to <i>L. destructor</i>	9	1	< 0.01
RAST to <i>T. putrescent.</i>	0	0	NS

Table 3
Comparison between the baker group and control group of RAST score to storage mites (3 species). The RAST score is graded into classes 0 to 4

<i>A. siro</i>	RAST				<i>n</i>
	0-1	2	3	4	
Bakers	15	6	2	0	23
Controls	14	2	1	0	17
<i>P</i> : NS					
<i>L. destructor</i>	RAST				<i>n</i>
	0-1	2	3	4	
Bakers	15	6	2	0	23
Controls	14	1	2	0	17
<i>P</i> : NS					
<i>T. putrescentiae</i>	RAST				<i>n</i>
	0-1	2	3	4	
Bakers	21	2	0	0	23
Controls	15	1	1	0	17
<i>P</i> : NS					

3. RAST (Al-RAST) to the three storage mite species, yeast, soya and the four types of flour (gluten instead of barley) (Diagnoselaboratoriet ALK, Copenhagen). The RAST results were graded into classes 0 to 4.
Only skin prick results of ≥ 2 + and RAST ≥ class 2 were accepted as positive.

Statistics

In the comparison between groups we used the Mann-Whitney test for data on ratio-interval scale and chi-square test for data on ordinal scale. The level of significance was chosen to be 0.05 two-tailed.

RESULTS

Comparing those in the baker group with a positive RAST to one or more type of flour (*n* = 7) with those with negative RAST to flour (*n* = 16), we found that positive RAST to flour was related with positive RAST to *A. siro* and *L. destructor*, but not *T. putrescentiae* (Table 2).

Comparing the baker group as a whole and the control group we found no difference in the

RAST scores to any of the three storage mite species (Table 3). Neither did we find a difference between the baker and control groups in prevalence and strength of positive SPT to any of the three storage mite species. Most participants in both groups had very weak reactions ($\leq 1+$) and the distribution of positive reactions was almost equal among the three mite species.

The levels of total IgE were comparable in the two groups with median values of 13 kU/l (range 1-4,207 kU/l) and 32 kU/l (range 0-568 kU/l) (baker and control groups respectively).

Tables 4 and 5 give details on total IgE and RAST in both groups to the three storage mite species, four types of flour, soya, and yeast. It is seen that seven (30 %) in the baker group had a positive RAST to one or more flours and that gluten, whole wheat and rye gave the strongest reactions. Further, almost all bakers sensitized to flour were also sensitized to storage mites (6 of 7). Only one baker was sensitized to flour

only, while three bakers were sensitized to storage mites only.

Among the seven former bakers, four had negative RAST to storage mites and flour, two had positive RAST to *A. siro* and *L. destructor* and flour, and one was sensitized to storage mites (*L. destructor* and *T. putrescentiae*), but not to flour or soya.

Four in the control group (24 %) had a positive RAST to one or more storage mite species. Only one person had positive RAST to flour; she also had positive RAST to storage mites.

DISCUSSION

Occupational allergic diseases in the form of bronchial asthma and rhinitis due to hypersensitivity to flour are relatively common among bakers. In cross-sectional studies from recent years, prevalences of baker's asthma range from 6 % to 11 % (4, 6, 10) while work-related allergic rhinitis was prevalent in approximately 20 % (4, 10).

Table 4
Results of RAST and total IgE in the baker group. RAST is given in classes, total IgE in kU/l

No.	Job	IgE	A.s.	L.d.	T.p.	Flour	Yeast	Gluten	Wheat	Soya	Rye	Oats
01	B	58	2	1	1	1	0	-	-	-	-	-
02	B	4	0	0	0	0	0	-	-	-	-	-
03	B	197	1	0	0	2	1	1	1	0	1	0
04	B	4207	3	3	1	4	2	4	4	0	4	0
05	B	271	2	2	0	4	1	3	3	0	4	0
06	B	1224	3	3	2	4	1	4	4	3	4	0
07	B	13	0	0	0	0	0	-	-	-	-	-
08	B	157	2	2	1	2	1	0	0	0	0	0
09	B	1	0	0	0	0	0	-	-	-	-	-
10	B	4	0	0	0	0	0	-	-	-	-	-
11	Ex	70	0	0	1	1	1	-	-	-	-	-
12	Ex	44	2	2	1	3	1	2	3	0	3	0
13	Ex	7	2	2	0	4	0	3	3	1	4	0
14	Ex	5	0	0	0	0	0	-	-	-	-	-
15	Ex	11	0	0	0	0	0	-	-	-	-	-
16	Ex	3010	1	2	2	0	0	-	-	-	-	-
17	Ex	1	0	0	0	0	0	-	-	-	-	-
18	Ba	5	1	0	0	2	0	0	1	0	0	0
19	Ba	7	0	1	0	2	0	2	3	1	2	0
20	SA	12	0	0	0	0	0	-	-	-	-	-
21	SA	34	2	2	0	3	1	3	3	0	3	0
22	SA	45	1	1	1	1	1	-	-	-	-	-
23	SA	4	0	0	0	0	0	-	-	-	-	-

B. Baker, Ex: Ex-baker, Ba: Baker apprentice, SA: Bakery shop assistant. A.s.: *Acarus siro*, L.d.: *Lepidoglyphus destructor*, T.p.: *Tyrophagus putrescentiae*.

Table 5
Results of RAST and total IgE in the control group. RAST is given in classes, total IgE in kU/l

No.	IgE	<i>A.s.</i>	<i>L.d.</i>	<i>T.p.</i>	Flour	Yeast	Gluten	Wheat	Soya	Rye	Oats
01	34	0	0	0	1	0	-	-	-	-	-
02	40	0	0	0	1	0	-	-	-	-	-
03	78	0	1	0	1	1	-	-	-	-	-
04	71	0	0	0	1	1	-	-	-	-	-
05	5	0	0	0	1	1	-	-	-	-	-
06	41	0	0	0	1	1	-	-	-	-	-
07	30	0	1	0	1	1	-	-	-	-	-
08	568	2	3	2	0	1	-	-	-	-	-
09	29	0	0	0	1	0	-	-	-	-	-
10	439	2	1	1	2	1	0	0	0	0	0
11	8	0	0	0	0	0	-	-	-	-	-
12	101	1	1	1	0	0	-	-	-	-	-
13	0	0	0	0	0	0	-	-	-	-	-
14	1	0	0	0	0	0	-	-	-	-	-
15	70	3	3	3	2	0	2	2	2	2	2
16	29	1	2	0	0	0	-	-	-	-	-
17	1	0	0	0	0	0	-	-	-	-	-

Abbreviations: see Table 4.

Not all bakers with work-related asthmatic complaints react to extracts of wheat flour in prick test or in RAST. Prichard et al. (6) found in their study of 176 bakers in Australia, that 50 % of 20 bakers with a history of work-related asthma were negative in the prick test with wheat flour. It was not stated how many of these 20 persons had bronchial asthma before they became bakers. Järvinen et al. (4) in their study of 234 bakery workers in Finland found 21 with work-related asthma, of whom 19 had no asthmatic symptoms before working in bakeries. Of these 21 bakery workers 10 (48 %) had negative intracutaneous test to wheat, rye, barley and oat and negative RAST (class 0 or 1) to wheat and rye. Sutton et al. (9) examined sera from 39 persons (including 24 bakers) with suspected allergies to inhaled flour and found nine bakers (38 %) with a negative RAST to wheat.

As far as we know no previous studies have been conducted on storage mite allergy among bakers. Wraith et al. (12) found a few bakers among 210 patients with house dust mite or storage mite allergy. In addition, the frequency of contamination of flour with storage mites in bakeries or elsewhere is little investigated. Solomon (8) found that *A. siro* was the mite species most frequently encountered in flour and that

the grade of mite infestation was related to its water content.

We could not prove a higher prevalence or strength of positive SPT or RAST to storage mites in the baker group compared with a control group without occupational exposure to storage mites. This circumstance could be explained by 1) an unnoticed storage mite exposure among some of the controls, 2) that the sensitization to storage mites among bakers is comparable to that in the background population, or 3) the small size of our material.

However, almost all bakers (6 of 7) sensitized to flour (gluten, whole wheat and rye) were also sensitized to storage mites (RAST results). We suggest that if a baker become sensitized to flour he will be more prone to develop specific IgE towards storage mites too. A prospective study is needed to evaluate this hypothesis. Our results indicate that storage mite allergy might be prevalent among bakers with flour allergy and that storage mite allergy without flour allergy in bakers is probably rare.

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REFERENCES

1. Aas, K. & Belin, L.: Standardization of diagnostic work in allergy. *Acta Allergol.* 27, 439-468, 1972.
2. Cuthbert, O. D., Jeffrey, I. G., McNeill, H. B., Wood, J. & Topping, M. D.: Barn allergy among Scottish farmers. *Clin. Allergy* 14, 197-206, 1984.
3. van Hage-Hamsten, M., Johansson, S. G. O., Höglund, S., Tüll, P., Wiren, A. & Zetterström, O.: Storage mite allergy is common in a farming population. *Clin. Allergy* 15, 555-564, 1985.
4. Järvinen, K. A. J., Pirilä, V., Björkstén, F., Keskinen, H., Lehtinen, M. & Stubb, S.: Unsuitability of bakery work for a person with atopy: A study of 234 bakery workers. *Ann. Allergy* 42, 192-195, 1979.
5. Korsgaard, J., Dahl, R., Iversen, M. & Hallas, T.: Storage mites as a cause of bronchial asthma in Denmark. *Allergol. Immunopathol.* 13, 143-149, 1985.
6. Prichard, M. G., Ryan, G. & Musk, A. W.: Wheat flour sensitisation and airways disease in urban bakers. *Br. J. Ind. Med.* 41, 450-454, 1984.
7. Revsbech, P. & Andersen, G.: Storage mite allergy among grain elevator workers. *Allergy* 42, 423-429, 1987.
8. Solomon, M. E.: Tyroglyphid mites in stored products. Ecological studies. *Ann. Appl. Biol.* 33, 82-97, 1949.
9. Sutton, R., Skerrett, J. H., Baldo, B. A. & Wrigley, C. W.: The diversity of allergens involved in bakers' asthma. *Clin. Allergy* 14, 93-107, 1984.
10. Thiel, H. & Ulmer, W. T.: Baker's asthma: Development and possibility for treatment. *Chest* 78, 400-405, 1980 (Suppl.).
11. Warren, C. P. W., Holford-Strevens V. & Sinha R. N.: Sensitization in a grain handler to the storage mite *Lepidoglyphus destructor* (Schränk). *Ann. Allergy* 50, 30-33, 1983.
12. Wraith, D. G., Cunningham, A. M. & Seymour, W. M.: The role and allergenic importance of storage mites in house dust and other environments. *Clin. Allergy* 9, 545-561, 1979.

Address:

Dr. Poul Revsbech
Lungeklinikken
Aalborg Sygehus Syd
Postboks 365
DK-9100 Aalborg
Denmark

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