

Preventive Measures in Mite Asthma

A Controlled Trial

JENS KORSGAARD

Institute of Hygiene, University of Aarhus, and The Chest Clinic, Aarhus Municipal Hospital, Denmark

To evaluate the effect of preventive measures 46 patients, all allergic to house-dust mites (*Dermatophagoides* spp.), were randomly allocated to a study and a control group. According to the patients' subjective recordings of symptom score and use of medicine, compared with the control group, the study group had improved. There was, however, no improvement when comparing the objective recordings of morning and evening peak flow and use of medicine, and it is concluded that the preventive measures in this programme are not very effective for patients allergic to house-dust mites. The reduction in indoor humidity in the study group was limited and, as a high indoor humidity is the cause of huge populations of house-dust mites in homes, it is emphasized that future programmes of preventive measures should focus more on damp problems, particularly those related to bad housing construction.

Key words: asthma; damp; *Dermatophagoides*; house-dust mites; indoor climate; preventive measures.

Accepted for publication 21 September 1982

As early as 1928 Dekker (6) reported that preventive measures for reducing the amount of dust in bedrooms of patients with bronchial asthma caused by house dust had an amazing effect on the patients.

Later on it was realized (20) that allergens in house dust are often produced by house-dust mites (*Dermatophagoides* spp.), thus enabling a better rationalization of preventive measures for reducing exposure to house-dust mites. In this respect the abundant occurrence of house-dust mites, particularly in bedding (11, 15, 17), and the recognition (2, 10, 18) of low indoor air humidity as an important limiting factor to the occurrence of house-dust mites have become important knowledge when setting up measures to reduce the presence of house-dust mites in the home environment.

The purpose of the present study was to evaluate in a randomised controlled trial, the clinical effect of one such preventive programme on adult patients with mite-sensitive asthma.

PATIENTS AND METHODS

Incident (newly diagnosed) and consecutive asthma patients were selected for the trial from among patients attending the out-patient clinic at Aarhus Municipal Hospital or the out-patient clinic at Silkeborg County Hospital between December 1979 and March 1981. All patients were aged 15 years or older, and were selected as being allergic to house-dust mites according to the following criteria:

1. All had a positive skin test to extract of *Dermatophagoides pteronyssinus*.
2. All were RAST-class 3 or 4 (Pharmacia Phadebas RAST, range 0-4) to *D. pteronyssinus*.
3. All had a positive bronchial provocation test when challenged with extract of *D. pteronyssinus*.

Furthermore, patients with skin test reaction to other allergens known to occur in the indoor environment, e.g. animal dander and moulds, were excluded unless, in the case of animal

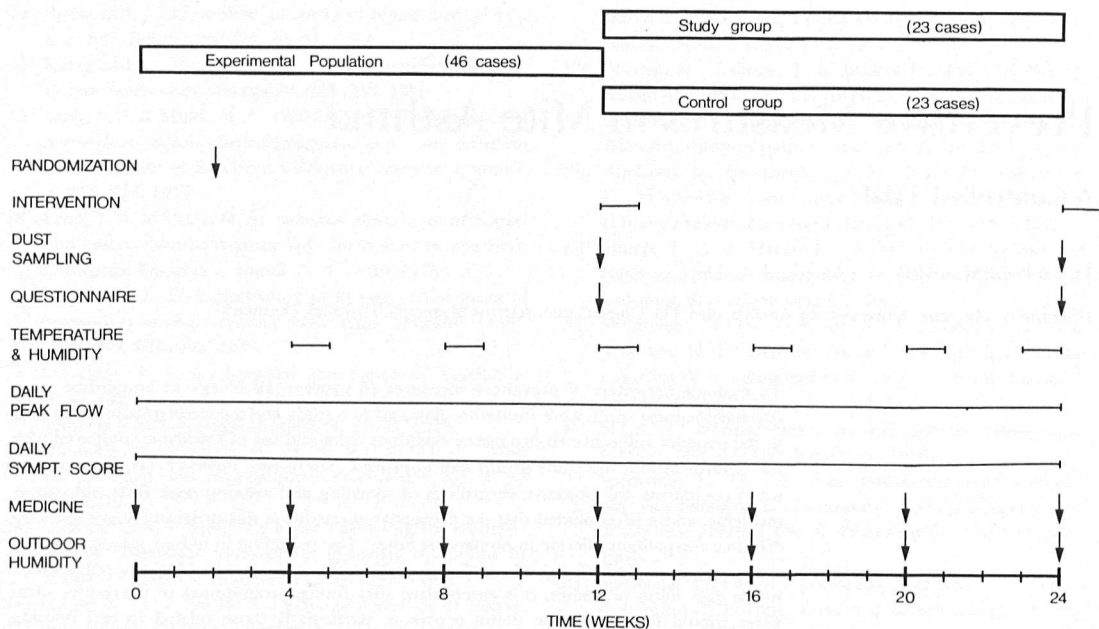


Fig. 1. Flow diagram showing the plan for the present trial.

dander, they had had no contact(s) with the pet(s) in question during the last year. Only patients who could be safely treated by a β_2 -agonist alone were included, as the use of medicine, as mentioned below, was chosen as one of the variables for clinical assessment.

The patients were included in the trial in successive order. The initial clinical evaluation included a standardized interview. After this the patients were followed-up with home visits every 4 weeks for 24 weeks (Fig. 1). In the first 12 weeks no changes were introduced in the patient homes. After being randomly allocated to either the study or the control group, the study group after the first 12-week period started on the programme of preventive measures, and all were followed-up during the final 12-week period, after which the programme of preventive measures was started in the control group.

All patients declared their willingness to participate after having received a written form describing the aim and extent of the investigation, including the possibility of being allocated to either a study or a control group.

Preventive measures

The advocated programme of preventive measures comprised:

1. Vacuum cleaning of all mattresses in the patient's bedroom twice a week.
2. Replacement of all quilts and pillows in the patient's bedroom with new synthetic quilts and pillows irrespective of condition and type of present bedding.
3. Bed linen should be changed and washed twice a week. This measure applied to all beds in the patient's bedroom.
4. If necessary, the type of flooring in bedroom should be changed, so that the whole bedroom floor is smooth and easy to clean, i.e. only a linoleum or wooden floor could be accepted. The bedroom floor should be cleaned twice a week.
5. To reduce indoor air humidity the bedroom should be thoroughly aired for at least 20 min every day, and a window should be half-open for 24 h, just as the window in the

living-room should be opened at least 20 min every day.

6. If possible, the drying of clothes indoors should be avoided.

No flowers or plants should be kept in the bedroom, and household activities involving the production of water vapour (cooking, bathing, cleaning, washing and drying of clothes, etc.) should be followed by a thorough airing. At the start the ventilation channels in bathroom and kitchen should be checked and cleaned if necessary. All patients had access to a vacuum cleaner, and all measures involving expenditure were paid for by the social services.

Clinical assessment

Each patient was equipped with a Mini-Wright peak flow meter and instructed in its use. Recordings of morning and evening peak flow measurements (highest of two peak flow readings) were kept throughout the 24 weeks (Fig. 1). Every 4 weeks the patients received a new terbutaline spray, the old one being weighed for an objective registration of the use of medicine. Furthermore, the patients were instructed to record symptom scores regarding their asthma and the frequency of their medicine intake. Recordings were made both 24-hourly and nightly.

Indoor climate

At the third visit (just prior to starting the preventive measures in the study group) the living habits and surroundings, i.e. frequency of cleaning, type and condition of materials, etc. were registered on a questionnaire. This interview was repeated at the sixth visit at the end of the trial (Fig. 1).

At the first visit to the patient's home a hygrometer and a thermometer were placed in the patient's bedroom to be read morning and evening for the following 7 days. These measurements of temperature and humidity were repeated for 7 days following each of the six visits (Fig. 1).

To assess the patient's exposure to house-dust mites, dust samples were collected from the

patient's mattress and from the bedroom and living-room floors with a portable vacuum cleaner with disposable paper bags. The whole upper surface of the mattress was vacuumed for 1 min, while dust samples from the floors were obtained by vacuuming an area of 70 × 70 cm for 1/2 min in the bedroom, just beside the patient's bed, and the centre of the living-room. Two patients (both controls) lived in a one-room apartment. Here the data were obtained as for the bedroom and included in both the sleeping and living room data.

All dust samples were processed within 5 h of sampling (for details on processing and counting of mites see (10)). The occurrence of house-dust mites was established by searching a 0.10 g aliquot of dust for mites. When less than 0.10 g dust was obtained by sampling, the counts given represent estimations of counts in 0.10 g aliquots from the weight of the dust sample and the content of mites in this sample.

Statistics

The statistical analysis was performed as Mann-Whitney U tests on the paired differences between weeks 1–12 and weeks 13–24 in study and control groups. All *P*-values were calculated on a SPSS-programme and represent two-tailed calculations corrected for ties.

RESULTS

A total of 51 patients were admitted to the trial, but three were unwilling to participate, one could not cooperate when using only β_2 -agonist as treatment, and one moved away during the trial. The remaining 46 patients with mite-sensitive asthma were randomly allocated so that 23 formed the study group, and 23 formed the control group. In both groups 7 were female. The median age was 30 (interquartile range (IQR) = 21–34) and 29 (IQR = 21–34) years in study and control group respectively.

As shown in Table 1 a majority of patients stated at the initial clinical interview that their asthma seemed worse at night or in the morning, and when being indoors at home. More than half stated that bedmaking or house dust

Table 1

Number of confirmative answers to questions regarding house-dust allergy. Answers were obtained before the patients entered the present trial

		Is your asthma worst			Is your asthma provoked by	
		At night or in the morning	Indoors	At home	Bedmaking	House-dust
Study	(23)	21	21	20	14	19
Control	(23)	17	21	21	16	14

Table 2

Bedroom inventory in the homes of a control and a study group (23 patients in each) before and after introducing preventive measures in the study group

	No carpets	Bedroom throw rug	Wall-to-wall carpets	Synthetic quilts pillows
Study week 12	1	3	19	8
Control week 12	6	1	16	13
Study week 24	23	0	0	23
Control week 24	6	1	16	13

provoked their asthma, and, as shown in Fig. 2, there was a clear seasonal variation in the number of days with asthma each month throughout the year, the worst months being August, September and October. In both groups 17 of 23 patients had complaints of rhinitis in addition to their asthma.

The first patient entered the trial in December 1979, the last in March 1981. As the admittance rate was unevenly distributed with respect to month of entrance (87% entered from September to February incl.), only 13% of the data were obtained from June to August, implying that measurements of the indoor climate are largely independent of the outdoor climate (8), and that only 10 patients (5 in each group) with skin reactions to pollens were followed-up during the relevant pollen season.

The 23 patients in the study group adhered well to the programme of preventive measures. Without exception all had obtained new quilts and pillows and when necessary changed carpeted bedroom floors to non-carpeted floors (Table 2). Although not all had strictly followed the instructions regarding frequency of cleaning, intensified airing of bedroom and living-room, and frequency of drying clothes indoors, it was obvious that the living habits in these respects had been drastically changed to follow the advocated scheme (Table 3).

From the highest of two peak flow readings in the mornings and evenings the median and interquartile range values were calculated for weeks 1-12 and 13-24 for each patient. There was no difference between the paired differences in peak flow morning and evening when comparing the study and control group (Table

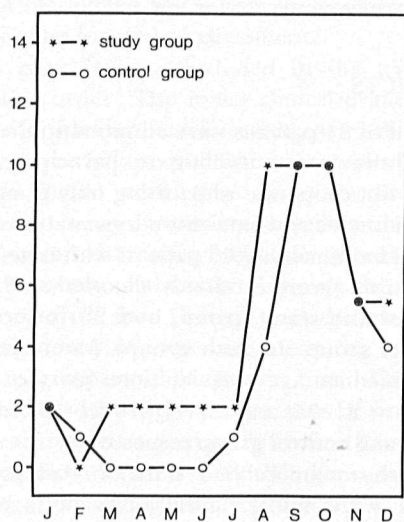


Fig. 2. Median number of days with asthma each month during the past year reported by 46 patients allocated to a study and a control group at the initial clinical assessment.

Table 3

Median and IQR of frequency of cleaning (times/year) and number of airing hours every day in 23 study and 23 control homes before and after introducing preventive measures in the study group

	Before (weeks 1–12)				After (weeks 13–24)				<i>P</i>
	Study group		Control group		Study group		Control group		
	Median	IQR	Median	IQR	Median	IQR	Median	IQR	
Cleaning of bed linen	26	26–36	26	26–40	104	52–104	26	26–40	0.0001
Cleaning of mattress	12	2–26	6	1–26	52	52–104	10	1–20	0.0001
Cleaning of bedroom floor	52	52–104	52	52–75	104	104–104	52	52–104	0.0061
Cleaning of living-room floor	104	52–104	52	52–104	104	52–104	75	52–104	0.8271
Airing hours in bedroom	2	0.3–2	2	1–8	24	18–24	9	1.5–12	0.0001
Airing hours in living room	0.1	0.0–0.2	0.2	0.0–0.5	1	0.3–4	0.5	0.2–4.0	0.7742

Table 4

Median and IQR for objective clinical assessment (morning and evening peak flow and g/month use of terbutaline spray) of a study and control group (23 patients in each) before and after introducing preventive measures in the study group

	Before (weeks 1–12)				After (weeks 13–24)				<i>P</i>
	Study group		Control group		Study group		Control group		
	Median	IQR	Median	IQR	Median	IQR	Median	IQR	
Peak flow (l/min) morning	460	400–540	450	380–530	490	420–560	460	390–530	0.3261
Peak flow (l/min) evening	470	430–590	475	410–540	490	430–600	490	410–550	0.8160
Use of terbutaline (g/month)	0.54	0.26–2.29	0.71	0.42–1.15	0.33	0.09–1.33	0.40	0.14–1.41	0.1630

4), although for the morning readings in the study group the paired differences tended ($P = 0.326$) to be better than in the control group. It seemed that both groups improved over the 24 weeks, the control group had an increase in morning peak flow of 2%, the study group a corresponding increase of 7%. Assuming that the paired differences of peak flow readings had a Gaussian distribution (which by probit-analysis was almost the case) the probability (1–

β) of detecting a real therapeutic improvement in morning peak flow in the study group compared with the control group of 5% and 10% is less than 0.20 and 0.01 respectively. Also according to the other objective measure of therapeutic improvement – the use (in g) of terbutaline spray every 4 weeks during the trial – it seemed that both groups had improved equally (Table 4).

Table 5

Median and IQR for subjective clinical assessment (daily recording of symptom score and number of terbutaline puffs taken in 24 h and at night separately) of a study and control group (23 patients in each) before and after introducing preventive measures in the study group. Patients graded the three symptoms: shortness of breath, cough and wheezing on a 0–3 scale daily. Counts given represent summarized weekly scores

		Before (weeks 1–12)				After (weeks 13–24)				<i>P</i>
		Study group		Control group		Study group		Control group		
		Median	IQR	Median	IQR	Median	IQR	Median	IQR	
Symptom score	24 h	9.0	5.5–14.5	9.0	3.0–16.5	3.0	1.0–10.5	7.5	2.0–10.5	0.0184
Symptom score	at night	5.0	0.0–8.5	4.0	0.0–9.5	0.5	0.0–4.0	3.0	0.0–7.0	0.0716
24 h use of	terbutaline	3.5	0.5–8.5	2.5	0.5–5.5	2.0	0.0–5.5	2.0	0.0–7.5	0.0332
Nightly use of	terbutaline	1.5	0.0–4.0	0.5	0.0–2.5	0.0	0.0–1.5	0.0	0.0–2.5	0.1515

Table 6

Median and IQR of mean indoor absolute humidity (g/kg) measured during 7 days, morning and evening, in bedrooms of a study and control group (23 patients in each) before and after introducing preventive measures in the study group

	Week 5		Week 9		Week 13		Week 17		Week 21		Week 24	
	Median	IQR	Median	IQR	Median	IQR	Median	IQR	Median	IQR	Median	IQR
Controls morning	8.0	7.2–9.6	8.1	7.6–8.8	8.0	7.3–8.9	7.6	7.3–9.0	8.4	7.3–10.2	9.0	7.9–10.0
Study morning	8.1	7.0–9.1	7.8	7.2–9.4	7.9	6.2–8.8	7.3	6.3–8.9	8.3	6.9–9.3	8.5	7.4–9.1
<i>P</i>	0.8004		1.000		0.4818		0.2483		0.3278		0.1627	
Controls evening	8.1	6.7–8.7	8.1	7.5–8.9	7.9	6.5–9.4	8.1	6.9–9.7	8.8	7.3–10.9	8.9	7.6–10.3
Study evening	7.6	6.3–8.2	7.3	6.4–8.1	6.7	5.8–7.7	6.5	5.2–8.6	7.4	5.4–9.0	7.8	6.9–9.3
<i>P</i>	0.2911		0.0926		0.0264		0.0409		0.0358		0.0825	

When the patients own 24-hourly and nightly recordings of symptom score and use of terbutaline are compared (Table 5), it appears that the study group had a significant improvement as regards 24 h symptom score and 24 h terbutaline use while the nightly recordings showed only tendencies toward improvement. Both

groups seemed to improve, but in contrast to the above-mentioned objective recordings the study group was significantly more improved than the control group.

One of the objectives of the preventive measures was to achieve, first of all by an intensified airing, a reduction in indoor air humidity. As

Table 7

Median and IQR of house-dust mites found in 0.10 g dust samples from three locations in the homes of a study and control group (23 patients in each) before and after introducing preventive measures in the study group

	Before (weeks 1–12)				After (weeks 13–24)				<i>P</i>
	Study group		Control group		Study group		Control group		
	Median	IQR	Median	IQR	Median	IQR	Median	IQR	
Mattress	55	23–346	44	5–398	122	18–230	64	8–378	0.1532
Bedroom floor	52	8–204	47	6–201	16	5–30	74	21–463	0.0001
Living-room floor	6	2–41	8	2–49	14	4–71	8	3–70	0.6760

Table 8

Median and IQR of amount (g) of house-dust collected in three locations from the homes of a study and control group (23 patients in each) before and after introducing preventive measures in the study group

	Before (weeks 1–12)				After (weeks 13–24)				<i>P</i>
	Study group		Control group		Study group		Control group		
	Median	IQR	Median	IQR	Median	IQR	Median	IQR	
Mattress	1.38	0.57–1.90	1.44	0.64–2.85	0.57	0.21–1.51	0.97	0.51–2.75	0.1268
Bedroom floor	1.14	0.36–2.72	1.01	0.31–1.67	0.04	0.01–0.07	1.08	0.32–1.40	0.0001
Living-room floor	0.81	0.66–2.24	1.33	0.44–2.71	0.89	0.47–2.25	1.26	0.51–2.65	0.1532

mentioned above the 23 patients in the study group, at the final interview, reported a drastic increase in airing hours, especially in the bedroom, both when compared with the conditions before the introduction of preventive measures and when compared with the conditions in the control group (Table 4). As seen in Table 6, recordings of the median absolute indoor air humidity in mornings and evenings during a 7-day period, showed a reduction in indoor humidity from week 13 and throughout the intervention period, but noticeably this was only when the evening humidities were compared, while there was no difference in the morning readings of absolute indoor air humidity.

A total of 43,867 mites were found in 0.10 g aliquots of the dust samples collected from both groups at weeks 12 and 24. Of these, 84% were classified as house-dust mites (*Dermatophagoides* spp.), 9% as *Tarsonemus* spp., and mites be-

longing to other species constituted 7%. The results mentioned below concern only the occurrence of house-dust mites.

Table 7 shows the median and IQR of the concentrations of house-dust mites at weeks 12 and 24 for the study and control groups. With the exception of counts made in dust from bedroom floor in the study group the counts tended to be higher at week 24 than at week 12, probably reflecting the influence of season. When the concentrations of house-dust mites are compared between the study and the control group, it appears that only for the bedroom floor location was the concentration lower in the study group after preventive measures had been taken.

The amount of dust sampled by the standardized sampling procedure was reduced from a median of 1.14 to 0.04 g for bedroom floor when comparing conditions before and

after the introduction of preventive measures in the study group. When compared with the control group (Table 8) the replacement of carpeted floors with bare and easily cleaned floors (Table 2) and the increased frequency of cleaning the bedroom floor (Table 3) in the study group resulted in a 20-fold decrease in the amount of dust sampled from bedroom floor.

DISCUSSION

The only previous controlled trial on preventive measures in house-dust allergy available when planning this trial reported (3) that preventive measures had no effect. The patients participating were selected on the single criterion: a positive skin test to *D. pteronyssinus*, and so it may be argued that a more restricted selection would produce a group of patients who would benefit from the measures. Therefore, it was decided, when selecting subjects for this trial, that the criteria for mite asthma should be positive skin, RAST and bronchial provocation tests. This was done, even though it limits the generalizability of the results obtained.

That the subjects in this trial are a rigid group with well-defined mite asthma is also evident from the seasonal variation in their symptoms, which closely correspond to earlier findings regarding patients with house-dust mite asthma (11).

Furthermore, it was decided to include only newly diagnosed patients, in order to secure that no patients were already undertaking preventive measures. That this was achieved is likely, because the frequency of cleaning reported by the families at the initial interview (week 12) corresponded closely to earlier Danish findings in 75 randomly selected subjects (8).

The fact that 10 patients were included in spite of skin reactions to various pollens could be a serious confounding factor in this trial. Although pollen in these cases was not considered an obvious precipitating cause of their asthma, it must be admitted that pollen allergies may have been operating in these cases.

It may also be argued that the patients included in this trial did not have very serious asthma as they could be treated with terbutaline spray alone. In the planning of the trial this was given serious consideration, but it was decided not to include patients requiring more intensive treatment because the use of preventive medicine would obscure the relation between exposure and disease. It should also be emphasized that some patients, as they had a very close contact with the investigator, were included who would otherwise have been treated with preventive medicine. It is conceded, however, that the results obtained may apply only to patients with moderate asthma.

Lastly, it could be argued that preventive measures which include replacement of mattress may be of more benefit to the patients than the measures used in this trial, just as a 12-week observation period may be too short to detect a clinical improvement.

There seemed to be a tendency to a greater improvement in the objective clinical assessments, i.e. morning peak flow and the use of terbutaline, in the study group compared with the control group. Both groups seemed to improve, probably reflecting seasonal and spontaneous improvements. For the morning peak flow readings the additional increase in peak flow for the study group was limited if any being less than 5%.

When comparing the patients' own subjective recordings of asthma symptoms and their use of medicine the study group improved significantly more than the control group. Although this could be due to the non-blinded design of the study, so that the patients in the study group neglected some of their symptoms, it might also be a real effect of the avoidance programme. In any case, when the objective and subjective assessments are viewed together, there is no reason to believe that the introduction of preventive measures in the study group had a dramatic effect on their asthma. Thus, my results do not support the conclusions drawn from uncontrolled trials (16, 22) that preventive measures are of great value in the treatment of mite asthma. Their results could be due to a seasonal or spontaneous

therapeutic improvement, which would agree with the present results.

The present results are more in agreement with previous results of uncontrolled trials (13, 21) and controlled trials in children (4, 5) and adults (3) suggesting that simple hygienic measures are not of much benefit to patients with mite-sensitive asthma. The present results are in remarkable agreement with the latter investigations (3, 4), with morning peak flow readings in the treatment period minus placebo of 2%.

Avoidance of carpets in the bedroom and increased cleaning habits of the study group greatly decreased the concentrations of house-dust mites and amount of dust from the bedroom floor, but not from the mattress surface. Concerning the amount of dust, this latter finding agrees well with the results of sequential vacuuming which shows (8) that only a limited amount of dust is removed when vacuuming the mattress surface once.

Calculations (1) and investigations (14) on indoor air humidity have shown that water vapour absorbed in the inventory of a house acts as a powerful buffer, and tends to dampen fluctuations in indoor air humidity. It thus seems likely that the increased airing of bedrooms, probably mainly in the daytime, could only reduce indoor air humidity for a short period of time, as is shown by the evening measurements. In the morning the buffer effect of water vapour in the inventory caused indoor air humidity to return to the previous level, and so the penetrability of the reduction in indoor air humidity achieved was limited. That the high indoor humidity, characteristic of the patients participating as compared with a matched control group (9), is caused not by poor window opening habits but rather by bad housing construction is a possibility that should be investigated further.

As the occurrence of house-dust mites is related to the humidity conditions in a home (2, 10, 18), and as the reduction in indoor air humidity achieved in the study group was limited, it is not surprising that no reduction in the concentrations of house-dust mites in dust from mattress and living room floor was ob-

tained in the study group after the introduction of the preventive programme. In both study and control group the concentration of house-dust mites in the two locations seemed to increase. The principal aim of the preventive measures – reduction in the occurrence of house-dust mites followed by clinical improvement – was not achieved.

As mentioned above the seasonal variation in symptoms of mite-sensitive patients correlated well with the variation in the occurrence of house-dust mites. In a recent study (19), where 42 children with asthma were sent away for a 9-month stay at high altitude, an improvement was observed in the first week and this was maintained without drugs during the whole 9 months. In this case the improvement is difficult to explain, other than as a result of a reduced exposure, which is likely as the occurrence of house-dust mites decreases with increasing height above sea-level (20). So there is good reason to believe that if a reduction in mite exposure can be achieved in the mite-sensitive patient's own home environment, an important improvement will result.

Thus the conclusion of the present controlled trial on avoidance measures in mite asthma should not be that preventive measures have no effect, but rather that those used at present are without much benefit. Other measures may prove to be very effective, and in this respect it seems justified to focus more on damp problems in the patient's homes. More information is needed on this topic, especially on whether bad housing construction could be the cause of too high indoor humidity.

Future research programmes, which could include immunochemical determination of allergens from *Dermatophagoides*, should elucidate these essential problems.

ACKNOWLEDGEMENTS

The author wishes to thank Anders Holst Andersen, M.Sc. for valuable help regarding the statistical analysis. I also wish to thank Thorkil Hallas, M.Sc., who revised the manuscript. Draco A/S kindly supplied me with Mini-Wright peak-flow meters and terbutaline sprays. The study was supported by the Danish Medical Research Council, Grant No. 12-1018.

REFERENCES

1. Becher, P.: Luftfugtighed. VVS 8, 319–320, 1973.
2. Bronswijk, J. E. M. H. van: House-dust biology. (Published by the author). Zoelmond, 1981.
3. Burr, M. L., St Leger, A. S. & Neale, E.: Anti-mite measures in mite-sensitive adult asthma: a controlled trial. *Lancet* *1*, 333–335, 1976.
4. Burr, M. L., Dean, B. V., Merrett, T. G., Neale, E., St Leger, A. S. & Verrier-Jones, E. R.: Effects of anti-mite measures on children with mite-sensitive asthma: a controlled trial. *Thorax* *35*, 506–512, 1980.
5. Burr, M. L., Neale, E., Dean, B. V. & Verrier-Jones, E. R.: Effect of a change to mite-free bedding on children with mite-sensitive asthma: a controlled trial. *Thorax* *35*, 513–514, 1980.
6. Dekker, H.: Asthma und milben. *Munch. Med. Wochenschr.* *75*, 515–516, 1928.
7. Korsgaard, J.: Indoor climate in Danish flats. The National Health Institute. Copenhagen 1981.
8. Korsgaard, J.: Preventive measures in house-dust allergy. *Am. Rev. Respir. Dis.* *125*, 80–84, 1982.
9. Korsgaard, J.: Mite-asthma and residency – a case-control study on the impact of exposure to house-dust mites in dwellings. (To be published).
10. Korsgaard, J. & Hallas, T. E.: Tarsonemid mites in Danish house dust. *Allergy* *34*, 225–233, 1979.
11. Maunsell, K., Wraith, D. G. & Cunningham, A. M.: Mites and house-dust allergy in bronchial asthma. *Lancet* *1*, 1267–1272, 1968.
12. Maunsell, K., Hughes, A. M. & Wraith, D. G.: Mite asthma, cause and management. *Practitioner* *205*, 779–783, 1970.
13. Newton, D. A. G., Maberley, D. J. & Wilson, R.: House-dust mite hyposensitization. *Br. J. Dis. Chest.* *72*, 21–28, 1978.
14. Ronge, H. E.: Bostadsklimatet i murverkshus och betonghus. Statens Råd för Byggnadsforskning. Handlingar nr. 38, Stockholm 1961.
15. Sarsfield, J. K.: Role of house-dust mites in childhood asthma. *Arch. Dis. Child.* *49*, 711–715, 1974.
16. Sarsfield, J. K., Gowland, G., Toy, R. & Norman, A. L. E.: Mite-sensitive asthma of childhood. Trial of avoidance measures. *Arch. Dis. Child.* *49*, 716–721, 1974.
17. Sesay, H. R. & Dobson, R. M.: Studies on the mite fauna of house dust in Scotland with special reference to that of bedding. *Acarologia* *14*, 384–392, 1972.
18. Spieksma, F. Th. M.: The house-dust mite *Dermatophagoides pteronyssinus*. Thesis, Leiden 1967.
19. Vervloet, D., Bongrand, P., Arnaud, A., Boutin, Ch. & Charpin, J.: Objective immunological and clinical data observed during an altitude cure at Briançon in asthmatic children allergic to house dust and dermatophagoides. *Rev. Fr. Mal. Respir.* *7*, 19–27, 1979.
20. Voorhorst, R., Spieksma, F. Th. M. & Varekamp, H.: House-dust atopy and the house-dust mite *Dermatophagoides pteronyssinus*. Stafleu's Scientific Publ. Comp., Leiden 1969.
21. Warner, J. O.: Mites and asthma in children. *Br. J. Dis. Chest* *72*, 79–87, 1978.
22. Østergaard, P. A.: The effect of eradication of dust in the bedrooms of children with asthma due to allergy to house dust. *Ugeskr. Laeg.* *141*, 2928–2931, 1979.

Address:

Jens Korsgaard, M.D.
 Hygiejnisk Institut
 Aarhus Universitet
 8000 Aarhus C
 Denmark

This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.