# Correlation of environmental mite levels & the symptoms of allergic rhinitis regarding the efficacy of preventive education

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**ABSTRACT:**

Allergic rhinitis is still a commonly investigated disease all over the world. Allergens are usually in the nature of glycoprotein or protein which interact with antibodies resulting in the formation of specific Ig E in the body 1. It is presumed that some environmental factors play an important role in their clinics. In allergic rhinitis, symptoms usually occur after the interaction of nasal mucosa with allergens. Allergens may be indoors, outdoors or in both environments. House-dust contains most of the indoor allergens. Mites are the most egregious allergen in house dust. *D. pteronyssinus* is commonly seen in European countries, *D. farinae* is mostly seen in North America. House-dust mites play an important role in allergic sensitization of individuals in Turkey. Perennial allergic rhinitis is a common chronic disorder that results most frequently from sensitivity to house-dust mites. National and international guidelines for the management of allergic rhinitis recommend that house and dust mite avoidance measures be considered for all patients with house-dust mite provoked rhinitis. Symptoms of allergic rhinitis are related to the environmental mite level in which patients live. The aim of this study is to show the relationship between mite levels and symptoms of allergic rhinitis diagnosed patients and the change of mite levels in the environment after appropriate education.

***Key words:*** Mite. Rhinitis. Education. Mite avoidance.

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## INTRODUCTION

Allergic rhinitis is still a commonly investigated disease all over the world. Allergens are usually in the nature of glycoprotein or protein which interact with antibodies resulting in the formation of specific Ig E in the body[1]. It is presumed that some environmental factors play an important role in their clinics.

Allergic rhinitis is a disease that occurs as a result of type I hypersensitivity affecting nasal mucosal membranes and allergic diseases of the respiratory tract, seen in 10-25 % of all populations[2]. The frequency of allergic rhinitis has increased nowadays such as bronchial asthma. The reason for this seems to be changing environmental factors and increased allergens and irritants inhaled through respiration.

In allergic rhinitis, symptoms usually occur after the interaction of nasal mucosa with allergens. Allergens may be indoors, outdoors or in both environments.

House-dust contains most of the indoor allergens. Mites are the most egregious allergen in house dust. The most common dust mite species around the world include[3]:

- *Dermatophagoides pteronyssinus* (Der p)
- *Dermatophagoides farinae* (Der f)
- *Euroglyphus maynei* (Em)
- *Blomia tropicalis* (Bt)

*D. pteronyssinus* is commonly seen in European countries, *D. farinae* is mostly seen in North America. House-dust mites play an important role in allergic sensitization of individuals in Turkey[4].

Perennial allergic rhinitis is a common chronic disorder that results most frequently from sensitivity to house-dust mites. National and international guidelines for the management of allergic rhinitis recommend that house and dust mite avoidance measures be considered for all patients with house-dust mite provoked rhinitis[5].

Symptoms of allergic rhinitis are related to the environmental mite level in which patients live.

The aim of this study is to show the relationship between mite levels and symptoms of allergic rhinitis diagnosed patients and the change of mite levels in the environment after appropriate education.

## MATERIALS AND METHODS

Sixty patients with detected allergy to house-dust mites were selected and included in this study. They were all initially clinically diagnosed after which skin-prick tests were performed and house dust mite allergy was detected in all. The symptom scores of all patients were recorded as previously published initially and after education period[6].

All patients having house dust mite allergy were instructed to collect and bring five packs of dust samples taken from the floors of their living rooms and bedrooms as well as their mattresses and pillows. Mites were detected in dust samples of 35 patients. These 35 patients were then educated in house dust mite avoidance. At the end of the six months, in a follow-up, they were told to bring dust samples once again.

House-dust mite levels of patients before and after the education and avoidance period were compared.

### House-dust mite Levels

Dust samples were collected by sweeping superficial dust or by vacuum cleaning from the major mite foci: floors, carpets, mattresses and padding from upholstered furniture in living rooms and bedrooms. Five samples were obtained from different places of the house by using different bags. The amount of dust collected in a single sample varied from 1 to 5 grams. All samples were stored at 4 °C until analyzed. Each sample was sieved and mites were recovered by the flotation method using dichloromethane (CH2C12)[7,8]. The number of mites found in a single sample was extrapolated to mites per 1 gram of dust. All specimens found were cleared with lactic acid and immersed in Swan's medium on slides in order to determine, with the use of a compound microscope, stage and species or higher taxonomic mite group.

### Education

All patients included in the study were given a detailed education in how to avoid house dust mite allergens. Patient education was given by the same doctor following the same list. It included[9]:

- Assessment of the home environment
- Description of mites (including their food)
- Conditions for optimal growth (humidity: > 55 % RH; temperature: 65°F-75°F)
- Local areas of dust mite growth (pillows, mattresses, box springs, carpets, upholstered furniture, draperies, stuffed animals/toys)

### Priorities for mites/allergens avoidance

*Bedroom*

- Encase pillows (< 10 μm pore fine woven or vapor-permeable cover)
- Encase mattress in vapor-permeable or plastic cover
- Encase box springs in vinyl or plastic
- Wash bedding weekly in hot (130°F) water

*House*

- Vacuum clean weekly (wear a mask; leave room for 20 minutes after cleaning)
- Ensure that vacuum cleaner has good quality bags (usually double thickness) or high-efficiency particulate air filter on the air outlet

### Long-term changes to decrease mites

- Reduce indoor relative humidity (with air conditioning, dehumidifier or opening windows depending on climate and season)
- Replace carpets with polished flooring (wood, vinyl, tile)

- Replace upholstered furniture with leather, vinyl or wood
- Replace draperies with wipeable shades or blinds
- Avoid living in basements

## RESULTS

Mites that were found in house dust samples are shown in table I.

*D. pteronyssinus* was found in all samples. In 28 of the samples 57 %, *Chortoglyphus arcuata* was detected together with *D. pteronyssinus*. Similarly, in 30 % of the samples, *Tyrophagus* sp. was detected together with *D. pteronyssinus*.

The number of house dust mite positive samples of 35 patients, before and after education, were compared with each other by using the Wilcoxon Signed Ranks Test, and the results were found to be statistically significant ($p < 0.001^{***}$).

There was not any statistically significant relation between the severity of symptoms and mite levels at home. However, the reduction of mite levels after education significantly decreased the severity of symptoms.

**Table I**

**Types of house-dust mites that were found in samples**

| Patients | Number of mite positive samples before education | Number of mite positive samples after education | Mites detected |
|---|---|---|---|
| 1 | 5 | 0 | *D. pteronyssinus* |
| 2 | 3 | 0 | *D. pteronyssinus* |
| 3 | 2 | 0 | *D. pteronyssinus* |
| 4 | 4 | 0 | *D. pteronyssinus* |
| 5 | 1 | 1 | *D. pteronyssinus* |
| 6 | 2 | 0 | *D. pteronyssinus* |
| 7 | 4 | 1 | *D. pteronyssinus* |
| 8 | 1 | 0 | *D. pteronyssinus* |
| 9 | 1 | 0 | *D. pteronyssinus* |
| 10 | 2 | 0 | *D. pteronyssinus* |
| 11 | 1 | 1 | *D. pteronyssinus* |
| 12 | 3 | 1 | *D. pteronyssinus* |
| 13 | 4 | 1 | *D. pteronyssinus* |
| 14 | 2 | 0 | *Chortoglyphus arcuatus* + *D. pteronyssinus* |
| 15 | 1 | 0 | *Chortoglyphus arcuatus* + *D. pteronyssinus* |
| 16 | 1 | 0 | *Chortoglyphus arcuatus* + *D. pteronyssinus* |
| 17 | 1 | 1 | *Chortoglyphus arcuatus* + *D. pteronyssinus* |
| 18 | 1 | 0 | *Chortoglyphus arcuatus* + *D. pteronyssinus* |
| 19 | 1 | 0 | *Chortoglyphus arcuatus* + *D. pteronyssinus* |
| 20 | 1 | 0 | *Chortoglyphus arcuatus* + *D. pteronyssinus* |
| 21 | 2 | 0 | *Chortoglyphus arcuatus* + *D. pteronyssinus* |
| 22 | 2 | 0 | *Chortoglyphus arcuatus* + *D. pteronyssinus* |
| 23 | 2 | 0 | *Chortoglyphus arcuatus* + *D. pteronyssinus* |
| 24 | 1 | 0 | *D. pteronyssinus* + *Tyrophagus* sp |
| 25 | 1 | 0 | *D. pteronyssinus* + *Tyrophagus* sp |
| 26 | 2 | 0 | *D. pteronyssinus* + *Tyrophagus* sp |
| 27 | 1 | 0 | *D. pteronyssinus* + *Tyrophagus* sp |
| 28 | 1 | 0 | *D. pteronyssinus* + *Tyrophagus* sp |
| 29 | 1 | 0 | *D. pteronyssinus* + *Tyrophagus* sp |
| 30 | 1 | 0 | *D. pteronyssinus* + *Tyrophagus* sp |
| 31 | 1 | 0 | *D. pteronyssinus* + *Tyrophagus* sp |
| 32 | 1 | 0 | *D. pteronyssinus* + *Tyrophagus* sp |
| 33 | 1 | 0 | *D. pteronyssinus* + *Tyrophagus* sp |
| 34 | 1 | 0 | *D. pteronyssinus* + *Tyrophagus* sp |
| 35 | 1 | 0 | *D. pteronyssinus* + *Tyrophagus* sp |

## DISCUSSION

One of the most important events in the history of allergic disease was the discovery that dust-mites are the major source of allergens in house dust. Asthma, perennial rhinitis and atopic dermatitis are the diseases most strongly associated with the sensitization to allergens derived from dust mites[9].

The house dust mite or aeroallergen is a tiny creature that lives in every home. It mainly lives in bedrooms and mattresses where it lives off human skin scales and forms part of the dust. It usually causes no harm, but some people are allergic to its feces. A skin-prick test can confirm the allergy. Therefore, we included in this study patients showing positive skin-prick tests to house and dust-mites.

House-dust mites are 0.2-0.3 mm in size, having one unsegmented body and eight legs. They need 75 % (55-88 %) humidity and 25 °C (17-32 °C) temperature for their growth and proliferation. Under common conditions, 1gram of house-dust contains 3,000 mites. Both body proteins and the feces of mites are allergenic, rapidly move in the air and arrive in nasal mucosa in 30 seconds[10,11]. Knowing the properties of house dust mites and teaching them to the patients could increase the efficacy of avoiding house dust-mites.

In developed countries, it is estimated that 15 % of the general population suffer from one or more allergic disorders, of which allergic rhinitis is the most common.

Perennial rhinitis is most often due to allergy to the house-dust mite. In such patients, house-dust mite avoidance is logical, but there is considerable uncertainty regarding the efficacy of interventions designed to reduce dust-mite exposure. National and international guidelines for the management of allergic rhinitis recommend that house dust mite avoidance measures be considered[5,12]. Data at present are only available for acaricides, HEPA filters and a bedroom based environmental control program. Therefore, if considered appropriate, these should be the interventions of choice[12].

House-dust mite allergy (*Dermatophagoides pteronyssinus* and *Dermatophagoides farinae*) is an important causative factor for allergic rhinitis[13]. For that reason, in our study we investigated dust samples for these mites primarily. Three methods were commonly used for mite assays on house dust samples: Direct microscopic detection after the flotation method; the ELISA method requiring special kits for Der p and Der f; and the ACAREX-TEST to determine the guanine content of the sample[14].

In our study we used the flotation technique to show the presence of house-dust mites.

There is a clear relationship between the degree of allergen exposure and the subsequent development of allergic conditions or the risk of sensitization. It is therefore useful to know how intensively a patient is exposed to house-dust allergens. This can be managed by measuring the content of Der p and Der f per gram of dust. This method is also suitable for the control of sanitation measurements, e.g. the avoidance of all dust sources in the bedroom and living room, the use of suitable materials for bedding, the application of acaricide products and the covering of mattresses with polyurethane coated materials. We aimed to use Der p and Der f levels to show the efficacy of education in allergic rhinitis patients included in this study. Since *D. farinae* is seen only in North America, we did not detect it in the dust mite samples included in this study.

In our work, we found Chortoglyphus arcuata and Tyrophagus sp. in the samples. Chortoglyphus arcuata and Dermatophagoides pteronyssinus have unique and common allergenic determinants. Tyrophagus sp. is also known as storage mites. It is an important allergen source and should be considered when Dermatophagoides pteronyssinus is thought to be a problem. Both Chortoglyphus arcuata and Tyrophagus sp. are inhaler allergens which may cause dermatitis and respiratory allergies.

In recent years, greater attention has been given to the role of indoor allergens as a cause of sensitization and allergic respiratory diseases. Although there is some controversy as to whether the reduction of indoor allergens always reduces symptoms in individuals allergic to mites, environmental avoidance is today one of the allergic disease management procedures recommended in several treatment guidelines[16-19]. As effective avoidance is used to prevent and treat allergic diseases, the education of patients and their parents is important for its success and efficacy[16,17,20]. In addition, it is has also been shown that dust mite sensitization can be reduced with simple mite avoidance which might, in turn, reduce the rising prevalence and need of pharmacological treatment of asthma and allergic rhinitis[21,22]. In this study, house-dust mite levels were significantly decreased after education demonstrated the importance of avoidance.

The socio-economic status of patients is important for effective allergen avoidance. In the case of patients in low socioeconomic status, education rises in importance. House dust mite control measures are based on the knowledge of factors contributing to mite development, especially indoor relative humidity. Mite allergen avoidance strategies include three different methods:

- Avoidance of mite producing allergens

• Elimination of mite reservoirs, especially textile reservoirs
• Dwelling designed to inhibit mite proliferation[23].

As a result, the avoidance of allergens by allergic patients depends on effective education. Avoidance alone or together with other treatments plays an important role in improving the allergic patient's quality of life. The education of patients and their parents is important, because avoidance can also reduce the use of pharmacotherapy.

## CONCLUSION

The avoidance of allergens in allergic disease is very important and depends on the patient's education. Avoidance measurements must be explained in detail and given to all allergic patients especially those with low socio-economic and/or cultural backgrounds.

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## REFERENCES

1. Durham SR, Church MK. Principles of allergy diagnosis. In: Holgate ST, Church MK, Lichtenstein LM, eds. Allergy. 2nd ed. Philadelphia: Mosby, 2001; 3-16.
2. Şekerel BE. Alerjik Rinit Tedavisi. Aktüel tıp Dergisi; 2002; 7: 41-5.
3. Milian E, Diaz AM. Allergy to house-dust mites and asthma. P R Health Sci J. 2004;23:47-57.
4. Kalpaklioglu AF, Emekci M, Ferizli A, Misirligil Z. A survey of acarofauna in Turkey: comparison of seven different geographic regions. Allergy Asthma Proc. 2004;25:185-90.
5. Sheikh A, Hurwitz B. House-dust mite avoidance measures for perennial allergic rhinitis: a systematic review of efficacy. Br J Gen Pract. 2003;53(489):318-22.
6. Cingi C, Aynaci S, Cakli H, Cingi E, Ozudogru E, Kecik C, Altin F, Bal C. Efficacy of long-term sublingual-oral immunotherapy in allergic rhinitis, Acta Otorhinolaryngol Ital. 2005;25:214-9.
7. Maunsell K, Wraith DG, Cunnington AM. Mites and house-dust allergy in bronchial asthma. Lancet. 1968; 1267-70.
8. Racewicz M. House Dust Mites (Acari: Pyroglyphidae) In The Cities Of Gdansk and Gdynia (Northern Poland). Ann Agric Environ Med: 2001;8:33-8.
9. Arlian LG., Platts-Mills TA. The biology of dust mites and the remediation of mite allergens in allergic disease. J Allergy Clin Immunol. 2001; 107(3 Suppl): 406-13.
10. Tekat A. Allerjenler ve Özellikleri. In: Önerci M, editor. Allerjik Rhinosinüzitler. Rekmay Ltd. Ankara: 2002: 62-107.
11. Cingi C. Mevsimsel ve Yıl Boyu Süren Alerjik Rinit. In: Önerci M, editor. Allerjik Rhinosinüzitler. Ankara: Rekmay Ltd.; 2002. p. 131-43.
12. Sheikh A, Hurwitz B. House-dust mite avoidance measures for perennial allergic rhinitis. Cochrane Database Syst Rev. 2001;(4):CD001563.
13. Leupold W. Sensitization to house-dust mites: importance and possibilities of allergen elimination. Kinderarztl Prax. 1992; 60: 186-9.
14. Kalpaklıoglu AF, Misirhigil Z, Gubruz L, Demirel YS. Evaluation of exposure to mite allergens; flotation, ELISA and Acarex comparative study. Allergol Immunopathol (Madr). 1996;24: 248-53.
15. Puerta L, Fernandez-Caldas E, Lockey RF, Caraballo LR. Sensitization to Chortoglyphus arcuatus and Aleuroglyphus ovatus in Dermatophagoides spp. allergic individuals. Clin Exp Allergy. 1993;23:117-23.
16. Fernandez-Caldas E. Dust mite allergens: mitigation and control. Curr Allergy Asthma Rep. 2002;2:424-31.
17. Cote J, Cartier A, Robichaud P, Boutin H, Malo JL, Rouleau M, Boulet LP. Influence of asthma education on asthma severity, quality of life and environmental control. Can Respir J. 2000; 7:395-400.
18. Mudd KE. Indoor environmental allergy: a guide to environmental controls. Pediatr Nurs. 1995;21:534-6.
19. Deschildre A. Allergens causing respiratory allergy: the aeroallergens. Arch Pediatr. 1999;6 Suppl 1:48S-54S.
20. Salerno M, Huss K, Huss RW. Allergen avoidance in the treatment of dust-mite allergy and asthma. Nurse Pract. 1992;17: 53-6, 61, 65.
21. Arshad SH, Bojarskas J, Tsitoura S, Matthews S, Mealy B, Dean T, Karmaus W, Frischer T, Kuehr J, Forster J. Prevention of sensitization to house-dust mite by allergen avoidance in school age children: a randomized controlled study. Clin Exp Allergy. 2002;32:843-9.
22. Halken S. Prevention of allergic disease in childhood: clinical and epidemiological aspects of primary and secondary allergy prevention. Pediatr Allergy Immunol. 2004;15 Suppl 16:4-5.
23. Pauli G, de Blay F, Ott M, Bessot JC. Mites and their allergens: identification and extermination methods. Allerg Immunol (Paris). 2001;33:333-5.