

The occurrence of and exposure to animal allergens

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Man lives in close domestic contact with certain animal species, of which dogs and cats are likely to be the most common, but guinea pigs, rabbits and hamsters too, are popular pets.

The keeping of furred animals is widespread in Western society. It has been estimated that every fourteenth person in Finland owns a dog and that every fourth person is daily in some kind of contact with dogs (12).

In the USA there are a 100 mill. pets, this to be compared to a population of 250 mill. people. Therefore, indirect exposure to pets can take place in many ways.

An epidemiological study in a Swedish county based on all school children ($n = 4 \times 10^5$) showed that out of 3.8×10^5 non-asthmatic children, 52 % have indoor furred pets (4). Both horse-riding and animal care are very common among children. The prevalence of such activities among girls is approximately twice that of boys. 25 % of the children ride and/or have contact with animals in barns and stables. The same investigation shows that among asthmatic children denying allergy to dander, the incidence of pet-keeping is higher (55 %) than among healthy children and the incidence of domestic pet-keeping by dander allergic asthmatic children is less (23 %) than of non-asthmatics.

Significant amounts of dog allergen can also be found in dust samples from homes where dogs have never been kept and these

allergens in our environment may induce dog allergy even without direct exposure to dogs (13).

Indirect exposure can take place in many ways: Hair and clothing of pet owners, in stairwells, buses, public buildings, etc.

Occupational exposure to animals is also significant and involves individuals in many different professional circumstances, e.g. veterinarians, farmers, biologists and other laboratory workers. Several prevalence surveys of laboratory animal allergy (LAA) to rats, mice, guinea pigs and rabbits have been published. The frequency of LAA is stated from 10 % to 30 % (1, 2, 3, 5, 11). The allergenic activity is not connected to the insoluble proteins of the hair but to water soluble proteins produced different places in the animals. Results show (6) that the urine of rats and mice is an important source of allergenic protein. Sensitisation to such heterologous protein can follow inhalation of airborne dust contaminated with urine.

Only little research has been carried out to determine allergens in products made of animal pelts such as carpets and knitting wool. Animal hair allergen found in dust samples may have been brought into the house in such products. Besides, animal hair allergens may originate from unwashed wool, carpets made of various animal hair (cow, goat, donkey and pig) and old upholstered furniture and mattresses (7).

DETECTION METHODS OF ANIMAL ALLERGENS

Animal hair and dander can be detected by microscopic methods identifying and counting of the hair. However, the active material from hair and dander is not hair proteins but secreted proteins on the surface of the hair or the unidentifiable dander. By using immunochemical techniques with rabbit antibodies, all potential allergens can be detected.

The accuracy and sensitivity of the microscopic and the immunochemical methods are incomparable: The microscopical method is used to measure the organisms or parts of organisms which include the potential allergens, whereas the immunochemical methods are used to measure the amounts of extractable potential allergens and include molecules extracted from degraded parts which would not have been detected in the microscope.

Counter current immunoelectrophoresis (CCIE) is a method which can be used to determine the content of allergens from animal hair and dander (8). The extract of the dust is analysed against specific rabbit antibodies raised against various allergens (dog, cat, horse, cow, guinea pig, rat, etc.). The results can be shown as the highest 2-fold dilution titer of the dust sample extract that gives a positive result with an error of 1 titer step.

In a routine analysis of 1,077 dust samples, dog allergens were found in 37 %. Cat allergens were found in 46 % out of 1,018 dust samples with a titer variation of 0–1024 (9). The limit of detection for cat allergen corresponds to 100 ng antigen 4 (Cat major allergen) per gramme dust (9).

Of course, it is of great importance to reduce the amount of animal allergens in the allergic patient's home. Results from dust samples collected different places in the home at the same time often show a lower titer in the patient's bedroom than in the other rooms as a result of elimination treatment. However, the titer values which are

present in the other rooms are often unacceptably high.

Animal hair allergy may also occur as an industrial disease as previously described. We have used the CCIE method to control the distribution and concentration of rat allergens in an animal research laboratory where some of the staff had allergic genes (9, 10).

Dust samples were collected from the floor in 20 rooms (offices, animal rooms and laboratories). Rat allergens per square meter were determined (ranging from 0.1 µg to 1050 µg). After an allergen elimination programme, including introduction of new cleaning procedures, a significant fall was observed (range 0.1 µg to 60 µg). It is worth noticing that the staff too, felt they had got a better indoor environment.

The immunochemical technique has shown to give valuable information and be a good supplement to the clinical data. The results of the dust analysis have been useful as a guideline to elimination treatment, and a successful elimination of the allergen source will be reflected by a drop in the titer found in the CCIE.

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