

Environmental and Social Influences on Skin Test Results in Children

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Skin tests with 13 inhalant allergens were performed in 788 children with respiratory allergy. Positive reactions were common to animal danders (65%), to grass pollens (55%) and to tree pollens (44%) but rare to moulds (13%) and to house dust mite (12%). Children exposed to cows, dogs or horses at home more often had skin test reactions to these allergens than the children not exposed, but reactions to cat dander occurred as frequently in children exposed to cats at home as to those not exposed. Reactions to tree pollens occurred most often in children from upper social classes and from urban areas and reactions to house dust mite occurred most often in children from lower social classes and from rural areas. Children with positive reactions to house dust mite came from larger families than children with negative test results.

Some of these results were unexpected and possible explanations are discussed.

Key words: allergy; animals; asthma; mites; pollen; skin tests.

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CLINICAL ASPECTS

Animal danders and pollens are the main allergens in children from the northern part of Finland with allergic respiratory diseases. The avoidance of pets at home may lessen but does not prevent sensitisation to animal danders. Tree pollen allergy occurs more often in children from upper social classes and from urban areas than in children from lower social classes and from rural areas. Allergy to house dust mites is rare and is concentrated in lower social classes, rural residents and members of large families.

The tendency towards atopic disorders in children is principally determined by heredity but the occurrence of such diseases may also be influenced by sex, the type of feeding in infancy and by such environmental factors as the type of residence (12) and the socioeconomic level of the family (5, 12). There is also some evidence that the prevalence of atopic diseases may be affected by exposure to potent allergens (4).

Recent studies have revealed that specific immediate hypersensitivity may have genetic control (8) and that the development of hypersensitivity is influenced by the allergen load during the susceptible period of infancy (3, 15). The present investigation was carried out in order to clarify whether the development of

specific immediate hypersensitivity is modified by environmental differences, social status or exposure to different allergens.

MATERIAL AND METHODS

The study involved 788 children, 492 boys and 296 girls aged 4-15 years (mean 8.1) referred because of asthma or allergic rhinitis during the years 1976-1981. The main diagnoses were allergic rhinitis in 321 and asthma in 467, of whom 304 also had signs of nasal allergy. Based on the system of the Official Statistics of Finland (11), the children were grouped into two categories designated as white collar (I-II) and blue collar (III-V) social classes.

Table 1
Allergens tested

Animal danders:
Cat, cow, dog, horse
Grass pollens:
Alopecurus, Kentucky blue, meadow fescue, timothy
Tree pollens:
Alder, birch, willow
House dust mite:
<i>D. farinae</i> or <i>D. pteronyssinus</i>
Moulds:
4-mould mix (<i>Alternaria</i> , <i>Aspergillus</i> , <i>Cladosporium</i> , <i>Penicillium</i>)

Skin tests were made on all children in the allergy laboratory of the Department of Dermatology, University of Oulu, with a test panel of 13 inhalant allergens, listed in Table 1. The allergens were glycerinated solutions for prick/scratch testing from Dome Laboratories (West Haven) with the exception of *D. pteronyssinus*, which was from Bencard, and freeze-dried animal danders and hairs from Allergologisk Laboratorium (Copenhagen). The tests were made by the prick or the scratch method, except in children of 10 years or older in whom epithelial allergens and moulds were tested intracutaneously using aqueous extracts. Reactions of at least half of the size elicited by histamine acid phosphate (Dome), 10 mg/ml in prick/scratch tests and 0.1 mg/ml in intracutaneous tests, were regarded as positive.

Statistical comparisons were made by using the Chi-square tests and the Kolmogorov-Smirnov two-sample test.

RESULTS

Positive test reactions to animal danders occurred in 513 (65%), to grass pollens in 433 (55%), to tree pollens in 346 (44%), to moulds in 99 (13%) and to house dust mite in 97 (12%) children. Table 2 gives the results when tested by the intracutaneous, the prick or the scratch method. The skin test results according to residence and social class are presented in Table 3. The occurrence of positive reactions to animal

danders and moulds was similar in all groups. Positive reactions to grass pollens were found more often in urban children from white collar classes than in urban children from blue collar classes, but in rural children such a difference was not evident. Reactions to tree pollens were most common and to house dust mite least common in urban children from white collar classes. Reactions to house dust mite were most common and to tree pollens least common in rural children from blue collar social classes. The family size was larger ($P < 0.01$) in children with positive skin test reactions to house dust mite than in children with negative reactions.

As shown in Table 4, the children exposed to cows, dogs, horses or some other animal (20 children were exposed to birds, guinea pigs or hamsters) at home more often had reactions to these allergens than the children not exposed. On the other hand, skin test reactions to cat danders occurred as frequently in children exposed to cats at home as to those not exposed. The influence of exposure at different ages was not studied. If the asthmatics only are taken into account, a difference was found only with cow dander reactions between children exposed and not exposed (42% and 24%, respectively, $P < 0.01$).

DISCUSSION

It has been generally accepted that allergen exposure is a prerequisite for the generation of an allergy. Hence many results in the present study were to be expected. Reactions to most animal danders occurred more often in children in close contact to these animals than in children who were not. Because in a northern climate the mite population is dependent on housing conditions (14, 16), prevalence of house dust mite reactions in the lower social groups can also be explained by differences in allergen contact.

However, many of the results cannot be explained simply by massive allergen exposure. There were many patients with positive reactions to animal danders who did not have close contact with these animals, and the re-

Table 2
Positive skin test reactions obtained by different testing methods

Allergen groups	Intracutaneous		Prick		Scratch	
	No. of children	Positive %	No. of children	Positive %	No. of children	Positive %
Animal danders	192	84	123	67	473	57
Grass pollens			176	59	612	54
Tree pollens			176	42	612	44
Moulds	192	23	123	7	473	10
House dust mite			176	19	612	10

Table 3
Influence of residence and social class on the occurrence of positive skin test results

Allergen groups	Urban			Rural		
	White collar	Blue collar	Significance of difference	White collar	Blue collar	Significance of difference
	%	%		%	%	
Animal danders	61	66	ns	68	65	ns
Grass pollens	60	48	$P < 0.05$	60	54	ns
Tree pollens	58	47	$P < 0.05$	51	32***	$P < 0.001$
Moulds	13	13	ns	12	12	ns
House dust mite	6	11	ns	8	19*	$P < 0.01$
No. of children	163	174		145	306	

ns = not significant.

* $P < 0.05$ when compared with urban blue collar classes.

*** $P < 0.001$ when compared with urban blue collar classes.

Table 4
The animal dander skin tests results in relation to animal contact

Animal dander tested	Contact at home	Positive skin test reactions		Significance of difference
		n	%	
Cat	yes	282	53	ns
	never	506	51	
Cow	yes	125	40	$P < 0.001$
	never	663	19	
Dog	yes	301	41	$P < 0.05$
	never	487	32	
Horse	yes	14	64	$P < 0.05^*$
	never	774	35	
Anyone	yes	462	69	$P < 0.01$
	never	326	59	

ns = not significant.

* With Yates' correction.

actions to cat dander occurred as often in children exposed at home as in those who were not. A similar phenomenon, but with dog dander allergy, has been published by Moore et al. (10). These results have two possible explanations. It has been assumed that animal dander extracts may give nonspecific skin test reactions (1), particularly when tested intracutaneously. Another and more likely possibility is that a very slight, or indirect exposure to animal danders, is enough to sensitize subjects genetically predestined. Vanto & Koivikko (17) often found dog dander allergens in house dust samples even in cases with no dog at home. Because of the clustering of allergies between different animal danders (2) and the possibility of cross-allergies (9), it is possible in theory to become sensitized after contact with animals of different species. The frequent occurrence of horse dander reactions can hardly be explained otherwise. In the asthmatics, the similar occurrence of positive skin test reactions to most animal danders in children exposed or not may be caused by the nature of the disease itself. Recent studies have revealed that in addition to allergy, asthma has many other aetiological factors (7).

The occurrence of skin test reactions to tree pollens more often in children from upper social classes and from urban areas cannot be easily explained. The tree pollen count in spring is abundant both in the countryside and in towns. Because there is a connection between tree pollen allergy and allergy to fruits and vegetables (6), and the use of these foodstuffs lessens in the lower social classes (13), the phenomenon of tree pollen allergy may be linked to the diet of the family or to feeding habits in infancy.

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