

Specific IgE to reindeer epithelium in Finnish reindeer herders

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Reindeer herding is a major source of living for more than 4200 inhabitants in northern Finland. To determine the prevalence of allergic symptoms among reindeer herders clinical examinations and skin prick tests (SPT) with nine inhalant allergens were performed in 211 randomly selected men from 21 to 69 (mean 45) years. Specific IgE antibodies to reindeer epithelium (RE) and total serum IgE were evaluated in 99 herders, five persons who handled reindeer leather indoors, 21 atopic patients with cow allergy and another 20 subjects with specific IgE to other inhalant allergens. Positive SPT to RE was detected in one and specific IgE by using enzyme allergosorbent test (EAST) (≥ 0.8 PRU/ml) in seven herders. Specific IgE to RE was also demonstrated in one control. Using RAST inhibition a patient with cow allergy did not show cross-reactivity between cow and RE while another patient did. Thus, RE should be included in the allergy test panel when hypersensitivity to RE is suspected.

Key words: allergens; atopy; IgE; reindeer epithelium; skin tests.

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Allergic disorders caused by animal proteins have recently become one of the major diseases in occupational medicine (3, 4). Reindeer herding is a common occupation in northern Scandinavia. In Finland approximately 7000 inhabitants are engaged in herding reindeer and herding is the main source of living for more than 4200 people.

To elucidate the prevalence of allergic symptoms among reindeer herders we examined 211 randomly selected men from northern Finland. Clinical examination, SPT, patch test, as well as lung function tests were included in the study. In the present paper we report the results of specific IgE to reindeer epithelium (RE) in 99 reindeer herders, 21 atopics with specific IgE to cow epithelium (CE), 20 patients with specific IgE to other inhalant allergens, and five indoor workers

from workshops producing souvenirs of reindeer leather in Lapland.

SUBJECTS AND METHODS

Clinical examination

Clinical examination accompanied by SPT, patch test and lung function tests were conducted on 211 male reindeer herders randomly selected from the following three categories: 1) persons whose only work was reindeer herding, 2) reindeer herders who also worked as farmers, and 3) herders who also worked in offices. The mean working hours of the herders were highest among the full-time herders and lowest among those who also worked in offices. Their age varied from 21 to 69 (mean

45) years. In addition, five persons, aged from 30 to 62 (mean 43.4) years, from workshops which produce souvenirs of reindeer leather, were included in the clinical examination. The clinical data of the test subjects have been previously reported in detail (6, 8).

Skin prick tests

SPT was conducted on 211 herders and five indoor workers. They received neither conventional antihistaminic drugs for 3 days nor non-sedating antihistamines for 30 days before or during the test.

The nine SPT allergens were cat, cow, dog and horse epithelia, house dust mite (*D. pteronyssinus*), birch pollen, meadow grass pollen and mugwort pollen (Allergologisk Laboratorium A/S, ALK, Copenhagen, Denmark), at a concentration of 10 HEP (histamine equivalent prick) units and RE (Pharmacia, Uppsala, Sweden) at a concentration of 1:100 w/v.

The SPT were applied on the inner forearm, and the results were read after 15 min. Histamine dihydrochloride (10 mg/ml, ALK) was the positive control and 50% glycerol in water the negative control. A reaction at least half the size of that produced by histamine was considered positive.

Sera

Venous blood samples were obtained at the time of the clinical examination from all 211 herders and the five indoor workers. In addition, sera of nine herders with positive SPT to CE were tested, as well as sera of five indoor workers and 41 controls.

Control sera were obtained from patients examined at the Institute of Occupational Health, Helsinki, Finland. Twenty-one of the 41 control patients had clinical symptoms, positive SPT and specific IgE confirming CE allergy, and 20 patients had positive IgE to at least one other inhalant allergen. No history of exposure to RE was present in control patients. The sera of the test subjects and control patients

were stored at -20°C and thawed for use as needed.

Total serum IgE

The total serum IgE was determined by using commercially available Phadezym IgE-PRIST-test (Pharmacia Diagnostics, Sweden) according to the manufacturer's instructions.

Specific IgE to RE and CE

Specific IgE to RE and CE was measured by using an enzyme allergosorbent test (EAST) (Pharmacia Diagnostics) according to the manufacturer's instructions. RE discs for RE EAST were prepared in Pharmacia laboratories from a piece of newly slaughtered, dry and unwashed reindeer leather provided by the present study group. The RE discs have since been commercially available (Pharmacia Diagnostics).

RAST-inhibition test

RAST inhibition tests were performed as described earlier (9). Briefly, two serum samples (Pt1 and Pt2) in which specific IgE to RE and CE was detected by EAST (score 3 in both sera), were tested by using RE (Pharmacia Diagnostics, Allergen extract ren, *Rangifer Tarandus*, epithel & dander, D811111) and CE (ALK, Aguagen cow 1:100 w/v, 121186, Copenhagen, Denmark) as inhibiting allergens. Pt1 was from a reindeer herder with a positive prick test to RE, and Pt2 was from a control with cow allergy, who had never been exposed to RE. In RAST inhibition RE discs were used.

RESULTS

The results of clinical data, lung function tests, SPT and patch tests of 211 reindeer herders have been described elsewhere (6, 8). Briefly, using nine inhalant allergens in SPT, 19 (9%) of 211 herders had positive reactions to at least one allergen. A positive reaction to RE was

detected in one (0.5%). Past or present atopic dermatitis was diagnosed in 36 (17%) and allergic rhinitis in 29 (14%) reindeer herders. The herder with a positive SPT to RE was the only one to report allergic-type symptoms from reindeers.

The results of mean total serum IgE and specific IgE to RE among 90 reindeer herders appear in Table 1. Mean total IgE was 106.6 kU/ml and was highest (124.3 kU/ml) in herders who also worked in offices. Among them, specific IgE (≥ 0.8 PRU/ml) to RE was also the most commonly detected.

The results of the total serum IgE and specific IgE to RE among reindeer herders, indoor workers exposed to RE, and the controls are shown in Table 2. The highest mean total IgE (567.2 kU/ml) was detected in the patients with positive IgE to CE. Mean total IgE was lowest (16.2 kU/ml) among the indoor workers exposed to RE.

Specific IgE to RE (≥ 0.8 PRU/ml) was detected in seven (8%) reindeer herders and in two of nine herders with a positive SPT to CE. A positive SPT was detected in one herder who also had a positive SPT to CE.

Results of the determination of specific IgE to CE in those who had specific IgE to RE appear in Table 3. In three of 10 subjects with specific IgE to RE, the reaction to CE was < 0.8 PRU/ml.

RAST inhibition was performed by using two sera (Pt1 and Pt2) in both of which specific IgE to RE and CE was detected in EAST (Fig. 1). When the first serum (Pt1) was incubated with RE, an inhibition could be demonstrated while incubation with CE did not cause any signifi-

cant inhibition. With the other serum (Pt2) inhibition with RE and CE was roughly equal.

Of 21 patients with cow epithelium allergy, specific IgE to RE was found in one with the highest total IgE (6400 kU/ml) and in another with the highest level of specific IgE to CE (16.0 PRU/ml). In the patients with positive IgE to other inhalant allergens a positive IgE to RE was detected in one with high levels of specific IgE to dog epithelium (17.5 PRU/ml).

DISCUSSION

In the previous reports (6, 8), we have described the results of a clinical study among 211 reindeer herders. According to our findings, the prevalence of allergic symptoms and positive SPT to common inhalant allergens was roughly equivalent to the prevalence found in the general Finnish population. However, the reactivity to some allergens was even less frequent than was expected (4, 6). Only one herder had a positive SPT to RE. In addition, according to the results of clinical examinations and patch tests with 31 allergens, occupational skin disorders among reindeer herders were rare.

According to the previous literature, men have a higher prevalence of skin reactivity to common inhalant allergens than women (3). In addition, the other most important predictors of skin test reactivity appear to be age, urban residence and poverty status (3). One of the major contributions to the age-skin test relationship is the total serum IgE level which is usually highest in young people and tends to decrease with age (1). Skin test reactivity is lower and serum IgE levels are higher among smokers than in non-smokers (2).

Table 1

Mean total IgE and specific IgE to reindeer epithelium (RE), age and occupation in 90 reindeer herders

Occupation	n	Age (yr)		IgE kU/ml		RE-EAST ≥ 0.8
		$\bar{x}$	(range)	$\bar{x}$	($\pm$ SD)	PRU/ml
Reindeer herding only	30	39.1	(22-63)	95.6	($\pm$ 167.5)	1
Herder and farmer	30	51.2	(22-64)	99.9	($\pm$ 272.3)	2
Herder, office worker	30	40.7	(24-58)	124.3	($\pm$ 340.7)	4
Total	90	43.7		106.6	($\pm$ 266.9)	7

Table 2
Total IgE and specific IgE to reindeer epithelium (RE) in reindeer herders and their controls

	<i>n</i>	Age (yr)		Total IgE kU/ml		Positive	
		$\bar{x}$	(range)	$\bar{x}$	(+ SD)	RE-EAST	RE-SPT
						≥ 0.8 PRU/ml	<i>n</i>
Reindeer herders	90	43.7	(22-64)	106.6	(+ 266.9)	7	1
Herders with cow allergy	9	47.8	(23-61)	406.0	(+ 706.5)	2	1
Indoor workers with RE exposure	5	43.4	(30-62)	16.2	(+ 9.3)	1	0
Patients with cow allergy	21	37.4	(21-60)	567.3	(+ 1358.4)	3	NT
Patients with other allergies	20	36.5	(20-58)	436.0	(+ 741.7)	1	NT

NT = not tested, SPT = skin prick test

In the present study, all test subjects were men. There are only a few women in northern Finland whose main occupation is reindeer herding. In accordance with previous studies, we found that the mean total IgE varied in different occupation groups (3). The herders who also worked in offices had a higher mean total IgE than full-time herders or reindeer herders who also worked as farmers. The difference between the three groups could not be explained by age, because the mean ages of full-time herders and those who also worked in offices were roughly equal.

In accordance with previous studies, the mean total IgE was also associated with SPT reactivity in the present study (1, 5, 7). Mean total serum IgE was almost 4-fold higher among herders with positive SPT to CE (406 U/ml) than among other herders (106.6 U/ml).

Table 3

Specific IgE to cow epithelium (CE) in herders with specific IgE (≥ 0.8 PRU/ml) to reindeer epithelium (RE)

Subjects	IgE to RE (PRU/ml)	IgE to CE (PRU/ml)
K.V.	16.0	10.3
L.K.	7.4	2.7
A.K.	4.4	5.5
A.S.	3.4	2.3
S.A.	2.8	1.1
K.K.	2.4	0.1
J.K.	1.6	1.2
P.R.	1.0	0.1
K.S.	0.8	0.6
E.N.	0.8	1.7

Specific IgE (≥ 0.8 PRU/ml) to RE could be detected in seven (8%) of 90 herders and in two of nine herders with a positive SPT to CE. Two of them had a positive SPT to RE. The cause of the discrepancy between SPT and EAST results could not be established. However, the case histories were positive for reindeer allergy in only one subject who had a positive SPT to RE.

The specificity of positive EAST results to RE was tested with RAST inhibition by using two sera (Pt1 and Pt2) with specific IgE to RE and CE. It should be noted that Pt1 was from a reindeer herder with a long period of exposure to RE and a positive prick test with RE. Pt2, on

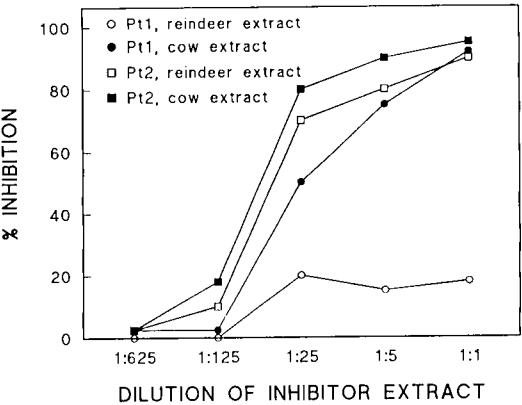


Fig. 1. RAST inhibition was performed by using two sera (Pt1 and Pt2, see text) which were incubated with different dilutions of RE and CE. Pt1 is from a reindeer herder and Pt2 from an atopic patient with cow allergy.

the other hand, was from an atopic patient with cow allergy and who had never been exposed to RE. After incubation of Pt1 with CE, no remarkable inhibition could be detected in RAST inhibition while incubation with RE showed a clear inhibition of 93%. The present finding shows that by using Pt1 we could demonstrate the presence of an unique allergen (allergens) in RE which does not appear in CE. The RAST inhibition results with the other serum (Pt2) show that the positive RE-EAST obtained with the control serum was due to common allergens in RE and CE.

According to the present study, the highest prevalence of positive IgE to RE was found in herders who also worked in offices. They also had the highest mean total IgE. In our previous studies we found that there were no statistical differences in smoking habits between the different groups of herders (8). Thus, smoking could not explain the difference either in mean IgE or in positive IgE to RE.

Among the indoor workers exposed to RE one of five had a positive IgE to RE. None of them had a positive SPT to RE. Souvenirs made of reindeer leather are usually produced in small workshops with few employees. Exposure to RE dust in the workshops is heavy because of the inefficient ventilation in these old buildings. Further studies are in progress to establish the amount of RE and other allergens in the air of these workshops.

A specific IgE to RE was detected in one subject with definite allergy to common inhalant allergens other than cow and without exposure to RE. The high total serum IgE might explain the result.

In conclusion, specific IgE to RE was measured in Finnish reindeer herders, atopic patients and subjects exposed to RE. High levels of RE-specific IgE antibodies were detected more often among part-time reindeer herders than full-time herders suggesting that heavy exposure to RE may cause tolerance rather than hypersensitivity. The specificity test by RAST inhibition demonstrated that RE has common antigens with CE but also species specific antigens. We suggest that the measurement of specific IgE to RE should be included in the test

panel of patients with suspected hypersensitivity to reindeer.

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