

A. Krakowiak · C. Palczyński · J. Walusiak
T. Wittczak · U. Ruta · W. Dudek · B. Szulc

Allergy to animal fur and feathers among zoo workers

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Abstract Objectives: This study determined the prevalence of respiratory symptoms and immediate hypersensitivity to feather and fur allergens and pulmonary function among zoological garden workers. **Methods:** Skin-prick test (SPT) reactivity to common and epithelium (hair) animal fur and feather allergens were examined in 68 zoological garden workers. All subjects responded to a questionnaire and underwent spirometry. Total and antigen-specific IgE were estimated among subjects claiming respiratory symptoms. **Results:** Forty-five subjects revealed positive SPTs with any inhalant allergen. Twelve reacted to feather extracts and 18 reacted to animal fur extracts. IgE specific for occupational allergens was seen in the serum of five subjects with SPTs positive to feather allergens and in the serum of 12 subjects with SPTs positive to fur allergens. Nose or eye symptoms were reported most frequently. Rhinitis and asthma were reported by atopic subjects more often than by non-atopic subjects. Occupational asthma due to feathers was diagnosed in 2% of zoo workers, and to fur in 10% of subjects working in contact with birds and furred animals. **Discussion:** The results suggest that occupational asthma caused by feathers is very rare in contrast to asthma caused by animal fur. Atopy predisposes to the development of allergic diseases caused by animal fur and feathers.

Keywords Occupational allergy · Animals · Birds

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A. Krakowiak (✉) · C. Palczyński · J. Walusiak · T. Wittczak
U. Ruta · W. Dudek · B. Szulc
Department of Occupational Diseases,
The Nofer Institute of Occupational Medicine,
P.O. Box 199, 8 Teresy Street, Lodz 90-950, Poland
Tel.: +48-42-6314769
Fax: +48-42-6314764

Introduction

Occupational allergy is an important health problem for those exposed to animals and birds [9, 12]. Feathers have been reported to cause asthma and rhinitis. Some data indicate that feathers can also cause atopic dermatitis [7]. Duck, goose and hen feathers are considered to be the more important causes of IgE-mediated allergic reactions.

Furred animals are consistently among the most commonly reported agents causing occupational asthma. About one-third of subjects who encounter laboratory animals in their workplace will develop allergic respiratory and skin diseases [10].

The purpose of the study was to determine the prevalence of respiratory symptoms and immediate hypersensitivity to feather and fur allergens and the pulmonary function among zoo workers. Up till now such data have not been determined among Polish zoo workers.

Material and methods

Subjects

The group studied consisted of 68 persons occupationally exposed to feather and fur allergens. The mean age of patients was 41.9 ± 11.6 . The diagnosis of bronchial asthma was based on the criteria of the American Thoracic Society [1], and the diagnosis of occupational allergy was based on a positive history and positive skin-prick tests (SPTs) with occupational allergens and/or the presence of specific IgE.

All subjects were informed about the experiment, and the tests were performed after their consent to participate in the study had been obtained. All human studies were reviewed by the local medical ethical committee and have therefore been performed in accordance with the ethical standards laid down in an appropriate version of the 1964 Declaration of Helsinki.

All subjects having animals or birds at home were eliminated from the study.

Definitions

In the analysis of the data the following definitions of sensitised and allergic subjects were used.

Individuals were considered to be sensitised to occupational allergens if they had positive SPTs or IgE specific for the allergen.

Subjects were considered to be allergic to feathers and/or animal fur if they were sensitised and showed evidence of respiratory symptoms, such as rhinitis, wheezing, tightness of the chest, coughing, or skin diseases that were clearly related to laboratory animals.

The patient was classified as atopic if at least one positive SPT reaction to any common inhalant allergens was seen.

Study design

Each subject underwent a medical history, physical examination, and pulmonary function testing by spirometry.

Questions of interest for this study were: family history of atopy or allergic diseases, past history of respiratory diseases, allergic symptoms specific for bronchial asthma, allergic rhinitis and atopic dermatitis, the presence of birds and laboratory animals at home, and smoking habits.

The symptoms were considered work-related if they appeared in connection with any specific animal or bird, or improved during vacations lasting more than 1 week.

Subjects were considered to be smokers if they had regularly smoked at least one cigarette or pipe a day for 1 year and had smoked during the 6 months preceding the study.

Subjects were considered to be ex-smokers if they had ceased smoking at least 6 months prior to the study.

SPTs were performed using common agents such as *Dermaphagoides pteronyssinus*, pollens, moulds, trees, house dust, and occupational allergens, such as dander of dogs, cats, rats, mice, rabbits, guinea pigs, hamsters, and feathers of hens, ducks, geese and parrots (Allergopharma, Germany). A negative control was made with the allergen diluent, and a positive control with histamine solution. All the sites were examined after 20 min: the grading of the wheal (4 mm > control was considered positive) and flare (5 mm > control – positive) reactions were conducted following standard methods.

Total serum IgE level and presence of IgE specific for such allergens as hens, ducks, geese, cats, dogs, rats, mice, rabbits, hamsters and guinea pigs were assessed (UNICAP, Pharmacia, Sweden).

In addition, a physical examination was carried out, and resting spirometry with the estimation of forced vital capacity (FVC) and forced expiratory volume in one second (FEV₁) with a spirometer (Vicat 2A, Vicat, Mijnhart, Holland) were determined.

Statistics

The statistical analysis was carried out by Fisher's exact test, when needed.

Results

Seven subjects out of 68 occupationally exposed to feathers and animal fur reported previous recurrent bronchitis, chronic sputum production or pneumonia.

A positive family history of allergic diseases was observed in 11 out of 68 taking part in the study. The characteristics of the group of zoological garden workers are presented in Table 1.

The mean duration of occupational exposure in the group of all subjects participating in the study was 15.7 ± 7.8 years.

The mean period of exposure to furred animals after which the subjects reported nasal symptoms was 1.2 ± 0.5 years, and for chest symptoms was 2.4 ± 0.7 years.

Table 1. Clinical and immunological findings in zoological garden workers

Parameter	Subjects working in zoological garden (n = 68)
Family history of allergic diseases	11 (16.2%)
Smoking habits	
Non-smoker	20 (29.4%)
Ex-smoker	15 (22.4%)
Heavy smokers	33 (48.5%)
Mean duration of occupational exposure	15.7 ± 7.5
Total IgE	76 ± 14
SPT positive to any inhalant allergen	45 (66.1%)
SPT positive to fur allergens	18 (26.4%)
SPT positive to feather allergens	12 (17.6%)
SPT positive to either fur or feather allergens	3 (4.4%)
IgE specific to fur allergens	12 (17.6%)
IgE specific to feather allergens	5 (7.3%)

Clinical allergy to feathers (nasal symptoms and asthma) appeared after a longer mean period of exposure – 1.9 ± 0.6 years and 3.2 ± 0.9 years, respectively.

Most subjects participating in the study had a positive history of smoking (Table 1).

The mean level of total IgE in the group of zoo workers was 76 ± 14 kU/l.

Forty-five subjects revealed positive skin reaction to any inhalant allergens. Twelve subjects reacted only to feather extracts, 18 to fur extracts and three to both feather and fur allergens.

IgE specific for occupational allergens was seen in the serum of five subjects with SPTs positive to feather allergens, and in the serum of 12 subjects with SPTs positive to fur allergens (Table 1).

Rhinitis, asthma and conjunctivitis were reported by atopic subjects more often than by non-atopic subjects (Fig. 1) ($P < 0.05$).

Occupational airway allergy due to fur allergens was reported more frequently than occupational allergy caused by feather allergens (Table 2).

Occupational airway allergy was observed more frequently in subjects with a positive history of smoking ($P < 0.05$) (Table 3).

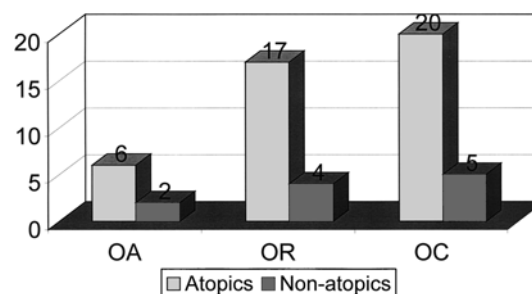


Fig. 1. The number of occupational allergic diseases in atopic and non-atopic subjects

Table 2. Frequency of occupational allergy among 68 zoo workers according to aetiological agent

Allergic symptoms	Aetiological agent (fur allergens)	Aetiological agent (feathers)
	Number of subjects	Number of subjects
Chest tightness (asthma)	7 (10%)	1 (1.5%)*
Nose symptoms (rhinitis)	16 (23.5%)	5 (7.3%)*
Eye symptoms (conjunctivitis)	19 (27.9%)	6 (8.8%)*

* $P < 0.05$ **Table 3.** Frequency of occupational allergy in subjects with a positive or negative history of smoking

Symptoms related with occupational exposure	Subjects with a positive history of smoking ($n = 48$)	Subjects with a negative history of smoking ($n = 20$)
Occupational rhinitis	18 (37.5%)	3 (15%)*
Occupational asthma	6 (12.5%)	2 (10%)
Occupational conjunctivitis	21 (43.7%)	4 (20%)*

* $P < 0.05$

Occupational asthma and rhinitis due to feather allergens were observed only in atopic subjects.

The authors observed a high frequency of SPTs positive to house-dust mite (HDM) allergens in the group of patients with diagnosed occupational asthma and rhinitis (Fig. 2).

The mean value of FEV₁ in the group of subjects with diagnosed occupational asthma was 3.5 ± 0.9 l/s and in the group of all subjects taking part in the study it was 4.7 ± 1.1 l/s.

The mean value of FEV₁ in the group of subjects with diagnosed occupational rhinitis was 4.9 ± 1.2 l/s.

Discussion

Subjects occupationally exposed to laboratory animals and feathers are at higher risk of developing work-

related allergic diseases, such as asthma, rhinitis, conjunctivitis and urticaria.

Atopy has consistently been identified as a risk factor for the development of allergy to animal fur [2, 8, 18].

Hollander et al. [11] have shown that elevated levels of total IgE (> 100 kU/l) is risk factor for allergy to laboratory animals. Also, in the present study, we noticed the presence of allergic symptoms both from the respiratory tract and from the skin more frequently in the atopic subjects.

The diagnosis of sensitisation was based on SPTs against hair and feather allergens or by the measurement of specific IgE in serum. In our opinion, SPTs positive to feathers are very common – 12 out of 68 zoo workers had positive results for them, although, to our surprise, clinical allergy from the respiratory tract is very rare. Some data indicated that SPTs positive to feather allergens may be reported in 20%–60% of subjects suspected to be allergic to feathers [4, 19]. Kilpio et al. [12] also found that clinical allergy to feather proteins is much rarer than is usually thought.

IgE specific to occupational allergens was seen in the serum of five subjects with SPTs positive to feather allergens and in the serum of 12 with SPTs positive to fur allergens. Several studies show, however, that specific IgE cannot be demonstrated, with the methods available, in many persons who experience symptoms [17].

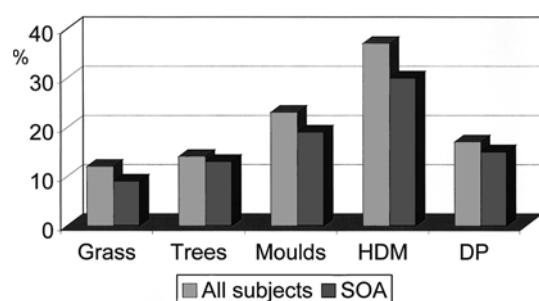
We diagnosed only one case of occupational asthma and two cases of occupational rhinitis due to feather exposure in the present study.

Among zoo workers, occupational asthma and rhinitis due to fur allergens were reported more frequently than occupational asthma and rhinitis caused by feather allergens. We found an incidence of laboratory animal allergy (asthma) of 10% (seven subjects) in 68 zoo workers. Newman-Taylor and Gordon [17] reported the prevalence of occupational asthma in 10% of workers who had been exposed to laboratory animals.

We, like other authors, have shown that the most common symptoms reported are rhinitis and conjunctivitis in subjects sensitised to fur allergens [6]. Asthma usually develops with or after the onset of other allergic symptoms.

In our study, allergy to feathers developed after a longer period of occupational exposure than did allergy to animal fur. Perhaps the explanation of this is that people living in towns more often have contact with laboratory animal and pet allergens than with allergens of birds such as hens, ducks, geese and parrots. For example, cat allergens have been found in settled dust samples from homes without cats [13, 15]. Some data indicate that even people who have never lived near cats become sensitised, implying that low-level exposure may be at least capable of inducing sensitisation [16].

Most patients with diagnosed occupational allergy due to fur and feather exposure were ex- or active smokers. Numerous studies have found an association between exposure to tobacco, and bronchial hyperreactivity and the diagnosis of asthma [5]. This agent has a

**Fig. 2.** Frequency of positive SPTs with common allergens among zoo workers

direct irritant effect on the mucous membrane and thereby damages its surface, allowing penetration of allergens. Our data are in agreement with other studies, although several other publications failed to demonstrate a relationship between allergy to fur and feather, and smoking [14].

Interestingly, we found a high frequency of positive SPTs with HDM and moulds among subjects with diagnosed occupational asthma and rhinitis due to feathers. The allergen profile of feather extracts is not fully known. The feathers of pigeons contain allergens of *Pterolichus* mites [3], the antigens such as keratin particles and IgA responsible for the development of bird-breeder's lung are contained in feather dust. It is possible, however, that it may be the result of cross reactivity between *D. pteronyssinus* and bird mites, which are frequently found in feathers.

Also in the group of subjects with diagnosed occupational allergy due to fur exposure, we noticed a higher frequency of positive SPTs with HDM.

We concluded that occupational asthma caused by feathers is very rare, in contrast to this disease caused by fur animals. Occupational allergy due to fur allergens is more often observed either in atopic subjects or in subjects with a positive history of smoking.

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