

WORK-RELATED RESPIRATORY SYMPTOMS IN BIRD ZOO KEEPERS — QUESTIONNAIRE DATA

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Abstract

Objectives: To investigate the risk factors for the development of airway diseases from occupational exposure to birds' allergens among Polish zoo garden keepers caring for birds. **Methods:** Two hundred workers responded to the questionnaire including the history of work-related symptoms, job characteristics, description of occupational exposure, information on smoking habit, contact with birds and animals at home and family history of allergic diseases. **Results:** General work-related symptoms were reported by 58 subjects (29%), whereas work-related respiratory symptoms were found in 40 workers (20%). The multivariate logistic regression analysis confirmed the significant role of positive family history of atopy and occupational contact with parrots either in the development of work-related symptoms or work-related respiratory allergic symptoms. **Conclusions:** The findings may confirm that work-related respiratory symptoms are an important health problem among zoo bird keepers in Poland.

Key words:

Allergens, Birds, Respiratory symptoms, Occupational exposure

INTRODUCTION

Professional bird keepers are at an increased risk of health problems from exposure to various occupational agents. Airborne contaminants in birds' cages include mixture of aerosolised agents, such as organic dust-skin debris, broken feather barbules, insect's remains, aerosolised food particles, birds' excreta, ammonia, and variety of viable bacteria, as well as airborne gram-negative bacteria and endotoxins [1–4]. Our data show that subjects working with birds are also exposed to disinfectants and latex allergens (LA). There are several reports suggesting that workers in this sector are at great risk for development of respiratory impairment [5–7]. Occupational allergy is an important health problem for bird keepers. Allergic conjunctivitis, rhinitis, asthma and skin symptoms may result from the contact with birds' allergens [8]. Feathers

have been reported to cause also bird breeder's lung (extrinsic allergic alveolitis — EAA) [7]. Epidemiological data from Poland have not, so far, included information on the prevalence or the risk factors (e.g. the species of the bird, period of work, contact with animals in the past) for occupational allergic diseases due to exposure to high and low molecular weight allergens among zoo bird keepers.

MATERIALS AND METHODS

Study population

The study group included 200 subjects employed at zoo gardens located in metropolitan areas of Łódź, Warszawa, Gdańsk, Chorzów and Płock. A field study was carried out in 2008 and it comprised a medical examination and

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a questionnaire survey. The study protocol gained approval of the Regional Biomedical Ethics Committee. All the participants gave their informed consent prior to the study.

Questionnaire

The questionnaire, supervised by a physician, was adapted from the instrument developed by the International Union against Tuberculosis and Lung Disease (IUATLD) [9]. The symptoms suggestive of asthma included dyspnoea, wheezing, chest tightness or cough under usual conditions or induced by exercise, exposure to cold air, smoke, dust or strong odours. The symptoms of rhinitis included sneezing, rhinorrhea, mucosal oedema and itching, while redness and oedema of eyelid, redness and oedema of conjunctiva, tearing and itching were indicative of allergic conjunctivitis. Respiratory, nasal and ophthalmic symptoms related with exposure to specific agents in the workplace and to agents out from work were also noted. The issues covered by the questionnaire included also job characteristics and description of occupational exposure. Two categories: smokers and nonsmokers were distinguished in the part enquiring about the smoking habit. The category of smokers encompassed current smokers and ex-smokers. Current smokers were defined as the subjects who reported smoking tobacco at time of survey and ex-smokers as those who had smoked daily and quit at least one month before the survey. Non-smokers category included only the subjects who had never smoked. Subjects having a pet in their childhood or before an onset of occupational contact with animals were defined as subjects with previous exposure to animals and/or birds.

Diagnostic criteria

The symptoms were considered to be work-related if they occurred after the contact with an occupational agent and receded or disappeared during weekends or holidays [10,11].

Statistical analysis

Continuous variables were expressed as mean values \pm standard deviations (SD), while nominal variables as numbers and percentages. Odds ratio (OR) with 95%

confidence interval was calculated for all the risk factors examined and separately for two outcomes: work-related symptoms and respiratory work-related symptoms using EPI INFO software (CDC, Atlanta, GA, USA). Factors found to be significant in the univariate analysis were included into the multivariate logistic regression model (Statistica 99) to predict each of the different outcomes. The *p* value below 0.05 was adopted as the reference for selection of significant risk factors.

RESULTS

Description of the study group

The investigated group included 200 subjects — 109 males and 91 females, respectively, with the mean age of 43.27 ± 13.59 years for the entire group. The mean duration of exposure to occupational allergens was 16.23 ± 12.08 years (Table 1). The majority of subjects participating in the study, 122 workers (61%), had a positive history of smoking (Table 2), while the positive family history was reported by 58 persons (29%). One hundred thirty seven (68.5%) subjects reported current contact with an animal at home, including 45 workers (22.5%) reporting contact with a cat, 102 (51%) with a dog, 23 (11.5%) with a parrot, 16 (8%) with a canary and 16 subjects (8%) with other birds (duck, goose, hen, pigeon and birds of prey). Seventeen (8.5%) workers reported contact only with birds at home. All questionnaire responses concerning animal and bird exposure at present and in the past are shown in Table 2.

One hundred thirty one workers (65.5%) reported contact in the past with at least one species of birds included in the questionnaire, 55 (27.5%) with a cat, 96 (48%) with a dog, 39 (19.5%) with a parrot, 19 (9.5%) with a canary and 30 workers (15%) with other birds.

One hundred forty eight workers (74%) used latex gloves in the workplace, and 139 workers (69.5%) were occupationally exposed to disinfectants during cleaning of the cages (Table 2).

General work-related symptoms were reported by 58 subjects (29%), while work-related respiratory symptoms were observed in 40 workers (20%). From questionnaire data,

Table 1. Study population characteristics according to duration of occupational exposure to birds

Analysed parameter	Number of subjects (%) N = 200 (100%)
Age (Mean±SD) (years)	43.27±13.59
Sex ratio: men/women [N(%)]	109:91 (54.5%:45.5%)
Duration of work with birds (Mean±SD) (years)	16.23±12.08
≤ 5 years	40 (20%)
6–10 years	33 (19.5%)
≥ 11 years	121 (60.5%)

Table 2. Study population characteristics

Analysed parameter	Number of subjects (%) N=200
Smoking status	
current smoker	71 (35.5%)
ex-smoker	51 (25.5%)
non-smoker	78 (39%)
Family history of atopy	58 (29%)
Contact with animals and/or birds:	137 (68.5%)
cat	45 (22.5%)
dog	102 (51%)
parrot	23 (11.5%)
canary	16 (8%)
other birds	16 (8%)
Contact with animals and/or birds in the past:	131 (65.5%)
cat	55 (27.5%)
dog	96 (48%)
parrot	39 (19.5%)
canary	19 (9.5%)
other birds (duck, goose, hen, pigeon and birds of prey)	30 (15%)
Contact only with birds at home	17 (8.5%)
Using latex gloves in the workplace	148 (74%)
Using disinfectants in the workplace	139 (69.5%)

we found that all work-related symptoms quoted above were related with occupational exposure to birds' allergens. The authors did not find any case of work-related respiratory, skin or ophthalmic diseases due to disinfectants or LA. No case of EAA was reported in zoo bird workers. Regarding the questionnaire responses, nasal symptoms were reported most frequently by subjects working

with birds. General nasal symptoms were found in 84 subjects (42%) out of the total number of 200 workers, while work-related nasal symptoms were reported by 33 subjects (16.5%) out of 200 workers. General ophthalmic symptoms were found in 57 subjects (28.5%), while work-related ophthalmic symptoms were noted in 27 workers (13.5%). Isolated chest symptoms were reported by 51



Table 3. Clinical symptoms: study group

Symptom	General symptoms	Work-related symptoms
Symptoms from the lower part of the respiratory tract	51 (25.5%)	7 (4.2%)
Nasal symptoms	84 (42%)	33 (16.5%)
Ophthalmic symptoms	57 (28.5%)	27 (13.5%)
Dyspnoea	25 (12.5%)	14 (7%)
Cough	43 (21.5%)	20 (10%)
At least one symptom from the respiratory tract	99 (49.5%)	40 (20%)
Skin symptoms	32 (16%)	12 (6%)

subjects (25.5%), while the work-related asthmatic symptoms occurred in 7 subjects (4.2%). General skin symptoms were found in 32 workers (16%), while work-related skin diseases in 12 ones. The prevalence of work-related symptoms reported by workers is shown in Table 3.

Statistical analysis revealed that subjects who had occupational contact with parrots more often complained of work-related symptoms in the workplace (Table 4). Also the multivariate logistic regression analysis confirmed the

significant role of occupational contact with parrots in the development of work-related symptoms (OR = 3.01; 95% CI: 1.48–6.13, $p = 0.002$). Univariate analysis showed that subject with positive family history of allergy more often reported work-related respiratory symptoms (Table 5). This observation was also confirmed by multivariate logistic regression analysis (OR = 2.45, 95% CI: 1.19–5.06, $p = 0.014$).

Table 4. Analysis of risk factors for general work-related symptoms in the study population

Factor	Subjects with work-related symptoms N = 58	Subjects without work-related symptoms N = 142	OR
Male	26 (44.83%)	83 (58.45%)	0.58 (0.3–1.12)
Female	32 (55.17%)	59 (41.55%)	1.73 (0.89–3.36)
Duration of work with birds			
≤ 5 years	11 (18.97%)	29 (20.42%)	0.91 (0.39–2.10)
6–10 years	16 (27.59%)	23 (16.20%)	1.97 (0.89–4.34)
≥ 11 years	31 (53.44%)	90 (63.38%)	0.66 (0.34–1.29)
Current smokers	22 (37.93%)	49 (34.51%)	1.16 (0.59–2.29)
Positive family history of atopy	22 (37.93%)	36 (25.35%)	1.80 (0.88–3.61)
Animals at home	40 (68.97%)	97 (68.31%)	1.03 (0.51–2.13)
Birds at home	34 (58.62%)	40 (28.17%)	0.97 (0.43–2.19)
Occupational exposure to:			
parrots	39 (67.24%)	60 (42.25%)	2.81 (1.41–5.65)*
canaries	28 (48.27%)	51 (35.91%)	1.67 (0.85–3.23)
pigeons	32 (55.17%)	60 (42.25%)	1.68 (0.87–3.27)
other birds (duck, goose, hen, and birds of prey)	33 (56.89%)	67 (47.18%)	1.48 (0.76–2.87)

* $p < 0.05$.

Table 5. Analysis of risk factors for work-related respiratory symptoms in the study population

Risk factor	Subjects with work-related respiratory symptoms N = 40	Subjects without work-related respiratory symptoms N = 160	OR
Male	16 (40%)	93 (58.1%)	0.48 (0.22–1.03)
Female	24 (60%)	67 (41.9%)	2.08 (0.97–4.53)
Duration of work with birds			
≤ 5 years	7 (17.5%)	33 (20.6%)	0.82 (0.28–2.11)
6–10 years	10 (25%)	29 (18.13%)	1.51 (0.59–3.61)
≥ 11 years	23 (57.5%)	98 (61.3%)	0.86 (0.40–1.85)
Current smokers	14 (35%)	57 (35.6%)	0.97 (0.43–2.11)
Positive family history of atopy	18 (45%)	40 (25%)	2.45 (1.11–5.33)*
Animals at home	29 (72.5%)	108 (67.5%)	1.27 (0.56–3.04)
Birds at home	9 (22.5%)	33 (20.6%)	1.12 (0.43–2.71)
Occupational exposure to:			
parrots	25 (62.5%)	74 (46.25%)	1.94 (0.90–4.26)
canaries	16 (40%)	63 (39.38%)	1.03 (0.47–2.20)
pigeons	20 (50%)	72 (45%)	1.22 (0.57–2.68)
other birds (duck, goose, hen, and birds of prey)	20 (50%)	80 (50%)	1.00 (0.47–2.12)

* $p < 0.05$.

DISCUSSION

Our results indicate that work in environment entailing occupational exposure to birds in zoo gardens is associated with increased frequency of respiratory and ophthalmic symptoms. From questionnaire data we found that most work-related symptoms had been associated with occupational exposure to birds' allergens. Feathers have been reported to cause allergic asthma, rhinitis and also atopic dermatitis [8,12], and are considered to be one of more frequent causes of IgE-mediated allergic reactions [6–8]. Samolinski [13] found that home exposure to animals (also to feathers) increased the intensity of allergic symptoms among pet owners — those data were presented in 2008, as the results of the completed project on epidemiology of allergic diseases in Poland — the ECAP study. Inhalable feather dust was shown to contain several allergenic components which cross-react with serum allergens/antigens of the same as well as of other bird species [14]. Well-defined major allergenic bands with molecular mass of 20–30 kDa and 67 kDa have been detected and identified

in IgE immunoblots with feather extracts as well as with serum proteins of budgerigar, parrot, pigeon, canary, and hen [14]. However, the allergenic proteins may be found not only in feathers, but also in bird serum, droppings, skin scales, and in the case of pigeons in a waxy fine dust which coats the feathers (pigeon bloom). Also feather mites are the major source of soluble proteins derived from feathers, accounting for up to 10% of the total weight of the feather [15]. Considering group of subjects occupationally exposed to birds' allergens, work-related symptoms were reported by 58 of them (29%), particularly work-related respiratory symptoms were found in 40 workers (20%). Muller et al. [16] found that about 20% of poultry workers complained of respiratory symptoms. We have shown that the most common work-related symptoms reported by zoo workers taking care of birds were nasal ones. The present study revealed that 84 subjects (42%) out of the total of 200 workers complained of nasal symptoms, whereas work-related upper airway symptoms were reported by 33 subjects (16.5%) out of 200 total. The present study

also revealed higher frequency of ophthalmic symptoms among zoo bird workers; general ophthalmic symptoms were found in 57 subjects (28.5%), while work-related ocular symptoms in 27 subjects (13.5%). Isolated chest symptoms were reported by 51 subjects (25.5%), while the work-related asthmatic symptoms by 7 subjects (4.2%). In our earlier studies published in 2002 [17], including 68 zoological garden keepers, we found occupational rhinitis due to feather exposure only in two cases, while occupational asthma only in one case. Also, in the study quoted above, Krakowiak et al. [17] noted that 6 zoo workers reported ophthalmic symptoms (allergic conjunctivitis) due to feather exposure. Rees et al. [18] studied 134 poultry workers and found that significantly more poultry workers than control persons complained of chest symptoms (increasing with longer exposure) and of eye, skin and nose irritation at work.

In our present study, logistic regression analysis confirmed that work-related respiratory symptoms occurred more often in subjects with positive family history of allergy. Several other studies described positive relationship between atopy and the development of IgE allergic reactions [19,20]. We have previously shown (data published in 2002), that occupational asthma and rhinitis due to feather allergens were observed only in atopic subjects [17]. Logistic regression analysis revealed that subjects who had occupational contact with parrots more often complained of allergic problems in the workplace. It should be mentioned that parrots have the largest number of pulviplumes [21]. These special feathers produce a very fine dust that resembles talcum powder, which can be inhaled and deposited in the lowest airways, as the particles' diameters are about 1 µm [22]. Some authors suggest that the structure and composition of those feathers may be important for increased prevalence of sensitisation to birds' allergens [20].

In contrast to other authors, we did not find a significant relationship between the prevalence of work-related symptoms and the period of work with birds. Zuskin et al. [1] found that poultry workers exposed for more than 10 years had significantly higher prevalence of almost all chronic respiratory symptoms than those with shorter exposure.

Contact with organic dust, especially due to close contact with pigeons, or other birds such as parrots, canaries,

budgerigars, doves, parakeets or finches [22] may be responsible for the development of EAA. To our surprise, no case of EAA was reported in zoo bird workers. The authors did not find any case of work-related disease due to disinfectants and LA. The present study does not confirm that current smokers are more predisposed either to the development of work-related diseases or work-related respiratory symptoms. Some data confirm the important role of smoking in the pathogenesis of occupational allergic diseases due to exposure to high molecular weight allergens, but the role of this agent in the development of EAA is still doubtful [23–25].

We conclude that work-related respiratory symptoms are an important health problem among zoo bird keepers in Poland.

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