Occupational Medicine 2013;**63:**563–567
Advance Access publication 30 October 2013 doi:10.1093/occmed/kqt116

Cat and dog sensitization in pet shop workers

I. Yilmaz[1], F. Oner Erkekol[2], D. Secil[1], Z. Misirligil[1] and D. Mungan[1]

[1]Department of Chest Diseases, Division of Immunology and Allergy, Ankara University School of Medicine, Ankara 06100, Turkey, [2]Immunology and Allergy Clinic, Atatürk Chest Diseases & Thoracic Surgery Training and Research Hospital, Ankara 06280, Turkey.

Correspondence to: I. Yilmaz, Department of Chest Diseases, Division of Immunology and Allergy, Ankara University School of Medicine, 06100 Dikimevi, Ankara, Turkey. Tel: +90 312 595 65 83; fax: +90 312 319 00 46; e-mail: insu2004@yahoo.com

Background	Sensitivity and symptoms related to animal proteins have been investigated in various occupational groups. However, data from pet shops are limited.
Aims	To investigate rates of sensitivity to cats and dogs among pet shop workers, to assess the relationship between sensitivity, allergen levels and symptoms and to investigate whether passive transport from pet shops to homes is possible.
Methods	Pet shop workers underwent interviews with a questionnaire adapted from the European Community Respiratory Health Survey. Dust samples for allergen detection were collected from pet shops using a vacuum cleaner. Skin tests were performed with common allergens. Dust samples were also obtained from the houses of 7 workers and 12 control subjects.
Results	Fifty-one workers from 20 pet shops were included in the study. Thirteen (25%) workers reported work-related symptoms. Four workers had sensitivity to animal allergens. The mean cat/dog allergen levels from pet shops were 15.7 and 3.2 μg/g, respectively. There was no significant relationship between cat/dog allergen levels and work-related symptoms and sensitivity to pets. None of the dust samples collected from the homes of pet shop workers contained cat allergens. Dog allergen was detected in only one house (0.58 μg/g). Neither cat nor dog allergens were found in the homes of the 12 control subjects.
Conclusions	Although a quarter of pet shop workers reported work-related symptoms, sensitivity to cat and dog was low. These findings suggest that work-related symptoms may be due to other factors than cat and dog sensitivity.
Key words	Allergen level; pet shop; sensitization.

Introduction

The prevalence of respiratory and cutaneous allergic symptoms in occupations that are exposed to animal proteins has been reported particularly in veterinarians and animal laboratory workers [1–3]. The total prevalence of respiratory allergic symptoms was ~23% while the prevalence for asthma was between 4 and 9% [2]. Furthermore, a dose–response relationship, stronger for atopics, has been reported between exposure and Ig-E-mediated allergies [4,5]. Despite the studies carried out in the occupations mentioned above, only one study has been conducted in pet shop workers on the frequency of respiratory symptoms and sensitivity rates to animals [6]. In that study, a large proportion of pet shop workers had respiratory symptoms and about a third were sensitized to the allergens found in pet shops [6]. However, there is a bias in Renström *et al.*'s study since these workers also had a near lifelong history of exposure to pets in their homes.

In Turkey, the number of pet shops selling mainly cats and dogs has increased recently although the rate of pet keeping is still very low. The aim of this study was to investigate the sensitivity rates to animals and the prevalence of respiratory symptoms among pet shop workers by evaluating both the occupational and home environment in terms of pet allergen exposure, in a country with a low pet-keeping rate.

Methods

The study was conducted in the Immunology and Allergy Clinic of a university hospital between August 2010 and March 2012. Pet shops registered with the Agricultural Directorate in Ankara, Turkey were determined and

© The Author 2013. Published by Oxford University Press on behalf of the Society of Occupational Medicine.
All rights reserved. For Permissions, please email: journals.permissions@oup.com

Downloaded from https://academic.oup.com/occmed/article/63/8/563/1464586 by ANKARA user on 11 December 2021

those with comparable conditions (localization, dimensions, animals sold) were selected for invitation to the study. All of the pet shops were located in the basement level of shopping malls. Cats, dogs, birds (parakeets, canaries) and, in a few of them, rabbits were sold. Cats and dogs were kept in open-top cages with a volume of 1 and 2 cubic metres, respectively. The pet shops were all well ventilated and cleaned every day.

Employees, who had worked in the shop for at least a year, who agreed to participate in the study and signed the informed consent form were included. Pregnant women and individuals who did not agree to skin prick tests (SPTs) were excluded. The study was approved by Ankara University Medical School's Ethics Committee, Decision No: 07-111. Each subject underwent a clinical interview to establish the type of job and exposure involved symptoms, the relationship between occupational exposure and symptoms, duration of occupational exposure, duration of symptoms and smoking habits. In this stage, a physician conducted a face-to-face interview, and a questionnaire adapted from the European Community Respiratory Health Survey was used [7,8]. After the interview, workers underwent SPTs with common and animal-specific allergens.

Dust samples were collected from the workplaces and houses of workers. As a control group, dust samples were also collected from individuals who did not work in pet shops and who had never kept a pet in their homes.

SPTs were performed using a common panel, including *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, grass, tree and weed pollens, cat, dog, feather mix, *Alternaria*, *Cladosporium* and cockroach allergen extracts (Allergopharma, Stockholm, Sweden). The positive and negative controls used were histamine (10 mg/ml) and phenolated glycerol saline, respectively. A mean wheal diameter of 3 mm or greater than the control solution was considered positive. In case of the detection of positivity in the test, the worker was defined as atopic. 'Family history of atopy' was defined according to the workers declarations.

Since daily cleaning was performed in the morning in the pet shops, dust samples were collected at 3 p.m. All samples were collected with a 1500W vacuum cleaner using a disposable filter and a filter collector (Mites collector; Indoor Biotechnologies, Charlottesville, VA, USA). Samples were taken from a 2 m^2 smooth area in front of the cages in pet shops and from 2 m^2 of the carpet in the living room of the houses. Every sample area was swept for 2 min.

A 100 mg amount of fine dust was extracted with 2 ml PBS–T (0.05% Tween 20 in phosphate-buffered saline, pH 7.4). The dust was re-suspended with a vortex mixer. Samples were then mixed in a shaker for 2 h at room temperature before being centrifuged for 20 min at 2500 RPM at 4°C. Supernatants were removed and stored at −40°C for future analysis of allergen content.

Analysis of cat (*Fel d* 1) and dog allergens (*Can f* 1) was performed using commercial ELISA kits (Indoor Biotechnologies, Charlottesville, VA, USA) according to the manufacturer's recommendations. The standards used to establish the control curve for *Fel d* 1 and *Can f* 1 assays were considered to contain 1000 ng/ml *Fel d* 1 and 2500 ng/ml *Can f* 1. The control curve dilutions are from 100 to 0.2 ng/ml for *Fel d* 1 and 250 to 0.5 ng/ml for *Can f* 1. Ten serial doubling dilutions were used in order to make the control curve. Dust extracts were initially assayed at 10-, 20-, 40-, 80-, 160- and 320-fold dilutions. For concentrations lying off the linear portion of the standard curve, the assays were repeated at appropriate dilutions.

Data are presented as mean ± SD. Values that were not normally distributed are presented as median and minimum–maximum. When data distribution was normal, differences among groups were examined by means of student's *t*-test. Otherwise, the Mann–Whitney *U*-test was applied. Nominal values were assessed using Chi-square test or Fisher's exact test. Correlations were examined using Spearman's non-parametric test or Pearson's test as appropriate. Results were considered significant when P values were <0.05. Data were analysed using SPSS v. 11.5 (SPSS Inc., Chicago, IL, USA).

Results

Of the 30 pet shops on the list, 21 met the inclusion criteria and 20 accepted a visit from the study team. Among the 65 pet shop workers in those pet shops, 51 agreed to take part in the study. Dust samples were collected from 20 workplaces and from the homes of 7 workers and 12 controls. The average working period for the participants was 7.4 years (range: 1–30 years). Their mean age was 27.5 years (range: 17–70 years), and 67% were current smokers. Atopy was found in 31% (16) workers with the highest rates to *Der f* (14%) and grass pollen (14%). Eight per cent (4) of workers were allergic to animal allergens. Sensitivity rates for feather mix, cat and dog were 6% (3), 4% (2) and 2% (1), respectively (Table 1). Cat and dog allergic subjects had other common allergen sensitivities as well. Forty-one per cent of pet shop workers kept at least one type of animal, mostly birds, (25%, 13) at home. The dog and cat keeping rates were far less than those for keeping birds (Table 1).

Twenty-five per cent (13) of workers complained of work-related symptoms. Sneezing, stuffiness, rhinorrhea, itchy eyes, watering eyes, cough, wheezing and dyspnoea were reported in 61% (8), 54% (7), 38% (5), 54% (7), 46% (6), 38% (5), 23% (3) and 23% (3) of these 13 workers, respectively. There were no differences in characteristics between workers according to presence of work-related symptoms (Table 2).

The workers with work-related symptoms reported birds (77%), dogs (8%), cats (8%) and dust (8%) as

Downloaded from https://academic.oup.com/occmed/article/63/8/563/1464586 by ANKARA user on 11 December 2021

causative factors. Atopy was found in seven (54%) of these workers. SPTs were positive for *Der p* in 38% (5) workers, *Der f* in 38%, grass pollen in 23% (3), cat in 15% (2) and feather mix in 8% (1).

Dust samples were collected from 20 pet shops. All of the dust samples contained measurable dog allergen levels. Measurable levels of cat allergens were found in seven pet shops. The cat and dog allergens, on average, were 15.7 μg/g (min–max: 0.7–80 μg/g) and 3.2 μg/g (min–max: 0–34 μg/g), respectively, in the dust samples collected from workplaces. A strong significant correlation was found between dog and cat allergen levels ($r = 0.643$, $P < 0.001$). None of the dust samples collected from the homes of seven pet shop workers contained cat allergens. Dog allergens were detected in only one pet shop worker's house (0.58 μg/g). Neither cat nor dog allergens were found in the homes of any of the 12 control subjects.

No statistically significant correlation was detected between pet shop allergen levels and sensitivity both to cat and dog. The average cat allergen level in dust samples from cat SPT-positive workers' workplaces was 2.6 μg/g (min–max: 0–5.3 μg/g) and 3.2 μg/g (min–max: 0–34 μg/g) for cat SPT-negative patients' workplaces. The dog allergen level in the dust sample from the workplace of the dog-sensitive worker was 7 μg/g, whereas the average dog allergen levels in dust samples from dog SPT-negative workers' workplaces was 15.9 μg/g (min–max: 0.7–80 μg/g).

Cat and dog allergen levels were not correlated with work-related symptoms. The median cat and dog allergen levels were 0 μg/g (min–max: 0–34.6 μg/g) and 9.6 μg/g (min–max: 0.7–80.4 μg/g) in the pet shops where workers had work-related symptoms and 0 μg/g (min–max: 0–34.6 μg/g) and 11.8 μg/g (min–max: 0.7–80.4 μg/g) in workplaces where the workers did not have work-related symptoms.

House dust samples were collected from seven workers' homes as mentioned above. The cat and dog allergen levels from the pet shops where these workers were employed (median: 4.8, min–max: 0–34.6 for cat; median: 15.7, min–max: 0.73–80.4 for dog) were not statistically different from the pet shops in which other workers were employed (median: 0, min–max: 0–34.6 for cat; median: 10.8, min–max: 0.7–80.4 for dog).

Table 1. Characteristics of pet shop workers ($n = 51$)

Age, years (±SD)	27.5 (±8.5)
Women, *n* (%)	5 (10)
Current smokers, *n* (%)	34 (67)
Atopy, *n* (%)	16 (31)
Working years, mean (±SD)	7.4 (±6.1)
Family history of atopy, *n* (%)	10 (20)
Pets at home, *n* (%)	21 (41)
Parakeets and/or canaries	13 (25)
Dog	7 (14)
Cat	2 (4)
SPT positivity, *n* (%)	
Der p	7 (14)
Grass pollen	7 (14)
Der f	6 (12)
Mould	4 (8)
Artemisia vulgaris	4 (8)
Tree mix	3 (6)
Feather mix	3 (6)
Cat	2 (4)
Dog	1 (2)

Discussion

This study demonstrated that allergy to cat and dog was low among pet shop workers despite the frequent presence of work-related symptoms. Furthermore, there were no correlations among symptoms and cat/dog sensitivity and workplace allergen levels. It is possible therefore that symptoms were due to other factors. Passive transport of cat/dog allergens from pet shops to homes did not appear to be occurring frequently.

This is the second study to examine work-related symptoms and allergic sensitivity in pet shop workers. Our study was conducted in a country with a low pet-keeping rate. However, the study has some limitations. The low number of samples make it difficult to make exact comments. In this study, vacuumed dust samples were used to

Table 2. Comparison of the workers with and without work-related symptoms

	Workers with work-related symptoms ($n = 13$)	Workers without work-related symptoms ($n = 38$)	*P*
Age, years (±SD)	26.3 (±4.6)	27.9 (±9.5)	NS
Current smokers, *n* (%)	8 (61)	26 (68)	NS
Atopy, *n* (%)	7 (54)	9 (24)	NS
Family history of atopy, *n* (%)	3 (23)	7 (18)	NS
Working years, (mean ± SD)	5.1 (± 3.5)	8.2 (±6.7)	NS
Had pets at home, *n* (%)	4 (31)	17 (45)	NS
Cat sensitivity	2 (15)	0	NS
Dog sensitivity	0	1 (3)	NS

NS, not significant.

Downloaded from https://academic.oup.com/occmed/article/63/8/563/1464586 by ANKARA user on 11 December 2021

measure allergen levels when it might be preferable to use air sampling. Another limitation is the lack of bird allergen level measurements and SPT results for bird allergen.

In the first study by Renström *et al.* [6], a large proportion of workers had workplace symptoms; a third had sensitivity to work-related allergens with exposure both at work and at home. In our study, one out of four workers described work-related symptoms and atopy was found in 31% of the subjects with the highest sensitivity rates to house dust mites. While symptom and atopy rates were quite high, sensitivity to animal allergens was less than expected. The low sensitivity ratios to cat/dog found in our study could be due to the low pet-keeping ratio in the homes of subjects, thus resulting in a lower rate of exposure to these allergens in their homes. Renström *et al.* [6] reported that 84% of pet shop workers kept at least three types of pets in their homes, the most common being dogs (84%) and cats (76%). However, pet-keeping rates were 14% for dogs and 4% for cats, and parallel with this finding, allergen levels were low in the houses of workers in our study. For these reasons, we believe that our study reflects the real effect of workplace exposure on the development of sensitivity to pets. Another explanation for the low sensitivity ratios could be the healthy worker effect where workers with sensitization to pets left this employment.

This study primarily focused on cat/dog allergens and sensitization to other animal allergens and other animal allergen levels were not investigated. The relative absence of keeping cats/dogs in homes seems to be an explanation for our lower rates of sensitization compared with those reported by Renström *et al.*'s study, since they found that cat allergen levels were 10 times higher in keepers' homes than in shops [6]. However, this situation can be less clearly relevant for other allergens, rodents and insects for example. Because Renström and *et al.* [6] found that allergen levels were 3.5-fold higher in samples from homes of non-mouse owners who worked with mice, than in homes of workers from shops without mice.

Pet shop workers reported frequent work-related symptoms in this study. However, neither sensitivity to pets nor allergen levels in the workplace had a correlation with the frequency of work-related symptoms. The presence of work-related symptoms could be explained by exposure to other allergens or non-specific irritants in the workplace. The most common trigger of symptoms reported by workers was exposure to birds. Surprisingly, the most frequent allergen causing sensitization was house dust mites. Bird feathers are known to contain high levels of allergens such as mite and fungal allergens. It is thought that the reason for reporting exposure to birds as the most common reason given for work-related symptoms is their exposure to mite and fungal allergens as a result of birds shaking their feathers. In addition, artificial airflow after the shaking of feathers can increase workers' exposure to cat, dog, mite and fungal allergens found on the floors of workplaces. However, we did not perform SPTs with bird allergens and also did not measure bird allergen levels and this is a major limitation of this study. Because of this, the relationship that we mentioned between symptom and mite/fungal allergen exposure can only be a comment not a precise result. However, work-related symptoms with exposure to birds have been reported in some studies [9,10]. In one of them, SPTs with bird allergen were made and an elevated sensitivity to birds was demonstrated [9].

Animal allergens are known to be transported easily. Furthermore, Tagiyeva *et al.* have shown the transfer of allergens to home in bakers [11]. In order to evaluate this situation in our study, house dust samples were collected from the houses of seven pet shop workers who had never kept animals in their homes. None of the dust samples collected from these homes contained cat allergens and dog allergen was detected in only one sample. Although the number of samples was low, transport of animal allergens to homes was rare in our study group. In contrast, other studies from high pet-keeping countries showed detectable levels of cat/dog allergen levels in homes without animals, although the level is lower than in homes with pets [12–15]. In our study, neither cat nor dog allergens were found in the homes of any of the 12 control subjects. These findings suggest that cat/dog allergen exposure due to passive transport is a less important problem in countries with low pet-keeping ratios.

Our findings show that cat/dog allergen sensitivity was lower than expected in pet shop workers, whereas work-related symptoms were frequent. Passive transport of pet allergens from pet shops to homes was not common. These findings suggest that pet sensitization in the workplace is a more complex issue related not just to workplace allergen exposure. Studies with larger samples and comparable conditions are needed.

Key points

- Sensitization to cats and dogs was lower than expected in Turkish pet shop workers.
- Our study did not find passive transport of cat and dog allergens from pet shop to homes.
- Sensitivity to cats and dogs among pet shop workers might vary in different populations.

Funding

The Scientific and Technical Research Council of Turkey, TUBITAK (project no. 110S249).

Conflicts of interest

None declared.

Downloaded from https://academic.oup.com/occmed/article/63/8/563/1464586 by ANKARA user on 11 December 2021

References

1. Krakowiak A, Wiszniewska M, Krawczyk P *et al.* Risk factors associated with airway allergic diseases from exposure to laboratory animal allergens among veterinarians. *Int Arch Occup Environ Health* 2007;**80:**465–475.
2. Seward JP. Occupational allergy to animals. *Occup Med* 1999;**14:**285–304.
3. Susitaival P, Kirk JH, Schenker MB. Atopic symptoms among California veterinarians. *Am J Ind Med* 2003;**44:**166–171.
4. Pacheco KA. New insights into laboratory animal exposures and allergic responses. *Curr Opin Allergy Clin Immunol* 2007;**7:**156–161.
5. Preece R, Renstrom A. Laboratory animal allergies and zoonoses. In: Hau J, van Hoosier G, eds. *Handbook of Laboratory Animal Science: Essential Principles and Practices*. 3rd edn. Vol. **1**. Boca Raton, FL: CRC Press, 2011; 115–144.
6. Renström A, Olsson M, Hedrén M, Johansson SG, van Hage M. Pet shop workers: exposure, sensitization, and work-related symptoms. *Allergy* 2011;**66:**1081–1087.
7. European Community Respiratory Health Survey II Steering Committee. The European Community Respiratory Health Survey II. *Eur Respir J* 2002;**20:**1071–1079.
8. Burney PG, Luczynska C, Chinn S, Jarvis D. The European Community Respiratory Health Survey. *Eur Respir J* 1994;**7:**954–960.
9. Swiderska-Kiełbik S, Krakowiak A, Wiszniewska M *et al.* Occupational allergy to birds within the population of Polish bird keepers employed in zoo gardens. *Int J Occup Med Environ Health* 2011;**24:**292–303.
10. Swiderska-Kiełbik S, Krakowiak A, Wiszniewska M *et al.* Work-related respiratory symptoms in bird zoo keepers–questionnaire data. *Int J Occup Med Environ Health* 2009;**22:**393–399.
11. Tagiyeva N, Anua SM, Semple S, Dick F, Devereux G. The 'take home' burden of workplace sensitizers: flour contamination in bakers' families. *Environ Int* 2012;**46:**44–49.
12. Munir AK, Einarsson R, Schou C, Dreborg SK. Allergens in school dust. I. The amount of the major cat (Fel d I) and dog (Can f I) allergens in dust from Swedish schools is high enough to probably cause perennial symptoms in most children with asthma who are sensitized to cat and dog. *J Allergy Clin Immunol* 1993;**91:**1067–1074.
13. Berge M, Munir AK, Dreborg S. Concentrations of cat (Fel d1), dog (Can f1) and mite (Der f1 and Der p1) allergens in the clothing and school environment of Swedish schoolchildren with and without pets at home. *Pediatr Allergy Immunol* 1998;**9:**25–30.
14. Custovic A, Simpson B, Simpson A, Hallam C, Craven M, Woodcock A. Relationship between mite, cat, and dog allergens in reservoir dust and ambient air. *Allergy* 1999;**54:**612–616.
15. Custis NJ, Woodfolk JA, Vaughan JW, Platts-Mills TA. Quantitative measurement of airborne allergens from dust mites, dogs, and cats using an ion-charging device. *Clin Exp Allergy* 2003;**33:**986–991.

EXCELLENCE IN EVIDENCE

Quality & speed

Advance Access publication from Oxford Journals



Articles published online ahead of print are available to read and cite with Advance Access.

www.oxfordjournals.org

OXFORD UNIVERSITY PRESS

Downloaded from https://academic.oup.com/occmed/article/63/8/563/1464586 by ANKARA user on 11 December 2021