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# Occupational allergy to dog among police dog trainers

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## KEY WORDS

*animal allergy; atopy; skin prick test; allergic rhinitis; sensitization*

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## Summary

*This study was aimed to reveal the prevalence of dog allergy and other common allergy and allergic symptoms in police dog trainers. Fifty-six police dog trainers and 150 workers as control group were included in this study. Medical records of dog trainers including respiratory, skin, eye symptoms and physical examinations and skin prick test results are compared with the medical records of control group. Positive SPT to dog was present in 21.4% of dog trainers, whereas the frequency of sensitization to dog in the control group was 1.3% ( $p < 0.001$ ). Dog allergy development risk is found 20 times greater in dog trainers than control group. In multiple logistic regression analysis, it was found that atopy was associated with dog allergy likelihood. Sensitization to dog allergens is an important occupational problem for dog trainers.*

## Introduction

Dog allergy is a worldwide problem that affects 5 - 10% of the adult population and is a common cause of asthma and allergic rhinitis (1-3). Animal allergy as an occupational hazard was reported especially in animal laboratory workers. There are few studies on occupational dog allergy. The respiratory and cutaneous allergic symptoms in occupations that are exposed to animal proteins have been reported particularly in veterinarians, veterinary technicians, animal laboratory workers and pet shop workers (4-8). The main sources of mammalian allergens are hair, dander, saliva and serum (9-10).

Allergy to mammals is usually caused by recurrent contact with mammalian allergens. It was determined that 70% of laboratory workers have developed allergies to animals in 2 - 4 years after exposure. In case of prolongation of exposure, one third of sensitized individuals could develop occupational asthma (11). In

this situation atopy is a significant risk factor. Atopy is defined as an increased propensity to mount an IgE antibody response to low-dose environmental aeroallergens. Atopy is generally established by detection of IgE antibodies to common environmental allergens, such as pollen and house dust mite.

In the literature, dog allergies have been reported among pet shop workers, veterinarians, workers in animal hospital, in animal shelters, and animal caretakers (12-16). There is no occupational allergy described in the literature in the profession group of police dog trainer.

In this article, we aimed to reveal the prevalence of allergic diseases in police dog trainers. We also evaluated allergic symptoms, skin prick test results, dermatological, respiratory system findings of police dog trainers. In addition, we investigated factors that were associated with the presence of allergy among these participants. As a result of this study, we aimed to find out whether there is a need for preventive programs against allergic

and respiratory diseases among this occupational group in Turkey, that is a country with a low pet-keeping rate.

## Materials and methods

### *Study design and participants*

This study was conducted in Ankara Occupational Diseases Hospital. In this hospital, different occupational groups are routinely examined at certain times. Fifty-six police dog trainers and 150 workers as control group were included in this study. Non-animal workers were selected as a control group from 5 different occupations (indoor workers). Medical records of dog trainers including respiratory, skin, eye symptoms and physical examinations, and skin prick test results were compared with the medical records of control group. The study was carried out in accordance in the Declaration of Helsinki. Institutional ethic committee approved the study and written informed consent was obtained from all participants. There were no subjects that had a dog as a pet at any time. Exclusion criteria of the study were taking antihistamine drugs in 15 days prior to hospital visit, severe common cold, dermatographism, and pregnancy.

### *Clinical history and examination*

From each participant, we obtained demographic details, smoking history, family history of atopy (at least one parent or sibling), detailed information about animal contact, occupational and non-occupational symptoms, pets at home and animal contact during previous jobs or education, and medical and occupational history. Rhinorrhea, sneezing and nasal congestion were considered as allergic rhinitis; cough, wheezing and shortness of breath were considered as pulmonary symptoms; itchy rash and urticaria were considered as skin symptoms; and eye itching and redness were considered as conjunctivitis. Symptoms were considered as work-related if they started after exposure to dogs at work in dog trainers' group.

### *Skin prick testing*

Skin prick tests (SPT) were performed using a common panel including feather mix, cat epithelia, dog epithelia, cow epithelia, goat epithelia, poultry, *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, *Alternaria*, *Aspergillus fumigatus*, tree and weed mix pollens, ash (*Fraxinus excelsior*), walnut, willow tree (*Salix caprea*), poplar (*Populus alba*), beech (*Fagus silvatica*), pine tree, latex, wheat, cockroach allergen extracts, a positive control (histamine, 10 mg/mL), and a negative control (Allergopharma, Stockholm, Sweden). Allergens were applied on the volar side of the forearm using lancets. Skin prick test results were read after 15 minutes, and were considered positive if the largest wheal diameter was at least 3 mm and surrounded by

erythema. Additionally, results of the negative control test were considered negative when the wheal diameter was less than 1 mm in the absence of erythema.

### *Statistical analyses*

Data were analyzed using the SPSS version 21.0 software program (Statistical Package for Social Sciences v.21, IBM, Chicago, IL). Pearson chi square test and Fisher's exact test were, where appropriate, used to investigate the association between categorical variables. The Student t test was used to compare continuous numerical variables between groups. To analyze risk of group, odds ratios (ORs) and their 95% confidence intervals (CIs) were calculated for each allergen in SPT. To predict skin prick test positivity to dog allergen, binary logistic regression was used for multivariate analysis of all potential predictors associated with sensitization to dog. All variables were forced to enter the equation in regression models.

## Results

### *General data*

This study included 206 subjects, including 56 in the dog trainer group and 150 in the control group. There was no difference in age between groups ( $p$  0.835). There was no difference in the proportion of female proportion between groups ( $p$  0.295). Characteristics of the study population are shown in **table I**.

### *Control group characteristics*

Of the control group ( $n$  = 150), 10 (6.6%) were female and 140 (93.3%) were male. The mean age of control group was 33.18 years (standard deviation  $SD \pm 14.83$ ; min - max 18 - 75 years). The current smoking rate was 21.3%. Subjects in control group worked at 5 different facilities (indoor workers), and their workplaces were free of exposure to animals. No worker worked in outdoor work.

Of the control group ( $n$  = 150), 44 (29.3%) subjects reported having rhinitis, 19 (12.6%) reported skin symptoms, 15 (10%) reported conjunctivitis, 6 (4%) reported ever having asthma.

Of the control group ( $n$  = 150), 31 (20.6%) subjects were sensitized to at least 1 common allergen in skin prick test. A summary of the skin prick test results of the subjects is given on the **table II**.

### *Dog trainer group characteristics*

Fifty-six dog trainer were examined. Of these 56 subjects, 1 (1.7%) was female and 55 (98.2%) were male. The mean age of dog trainer group was 33.6 years ( $SD \pm 6.37$ , min - max 25 - 52 years). The current smoking rate was 10.7%. The mean

**Table I** - Characteristics of the study population.

|   | Dog trainer group<br>(n = 56) | Control group<br>(n = 150) | p                    |
|---|-------------------------------|----------------------------|----------------------|
| characteristics of the population       |                               |                            |                      |
| age (y), mean ± SD (min - max)          | 33.6 ± 6.37 (25 - 52)         | 33.18 ± 14.83 (18 - 75)    | 0.835 <sup>1</sup>   |
| sex (female/male)                       | 1/55                          | 10/140                     | 0.295 <sup>2</sup>   |
| data from clinical history              |                               |                            |                      |
| smoking, yes (%)                        | 6 (10.7%)                     | 32 (21.3%)                 | 0.080 <sup>2</sup>   |
| rx smoker                               | 12 (21.4%)                    | 44 (29.3%)                 | 0.257 <sup>2</sup>   |
| family history of atopy, n (%)          | 17 (30.3%)                    | 31 (20.61%)                | 0.143 <sup>2</sup>   |
| time of dog work, year ± SD (min - max) | 6.02 ± 5.82 (0.5 - 20)        | -                          |                      |
| pet seeing (any kind of pets at home)   |                               |                            |                      |
| bird in the home                        | 4 (7.1%)                      | 9 (6.0%)                   | 0.764 <sup>2</sup>   |
| cat in the home                         | 2 (3.5%)                      | 12 (8.0%)                  | 0.261 <sup>2</sup>   |
| allergic symptoms                       |                               |                            |                      |
| rhinitis                                | 39 (69.6%)                    | 44 (29.3%)                 | < 0.001 <sup>2</sup> |
| rhinoconjunctivitis                     | 7 (12.5%)                     | 15 (10%)                   | 0.605 <sup>2</sup>   |
| allergic skin symptoms                  | 13 (23.2%)                    | 19 (12.6%)                 | 0.063 <sup>2</sup>   |
| asthma                                  | 1 (1.7%)                      | 6 (4%)                     | 0.435 <sup>2</sup>   |
| work related symptoms                   | 19 (33.9%)                    | 0 (0%)                     | < 0.001 <sup>2</sup> |

<sup>1</sup>Student t test, <sup>2</sup>Pearson chi square test.

**Table II** - The comparison of dog trainer group and control group in terms of the results of SPT.

| Skin prick test | Dog trainer group<br>(n = 56) | Control group<br>(n = 150) | p value <sup>1</sup> | OR <sup>1</sup> | 95% CI <sup>1</sup> |
|-----------------|-------------------------------|----------------------------|----------------------|-----------------|---------------------|
| dog             | 12 (21.4%)                    | 2 (1.3%)                   | < 0.001              | 20.18           | 4.35 - 93.60        |
| feather         | 1 (1.7%)                      | 0 (0%)                     | 0.272                | 0.982           | 0.94 - 1.01         |
| cat             | 10 (17.8%)                    | 9 (6%)                     | 0.009                | 3.406           | 1.30 - 8.89         |
| cow             | 1 (1.7%)                      | 0 (0%)                     | 0.272                | 0.982           | 0.94 - 1.01         |
| poultry         | 2 (3.5%)                      | 3 (2%)                     | 0.615                | 1.815           | 0.29 - 11.15        |
| goat            | 3 (5.3%)                      | 1 (0.6%)                   | 0.062                | 8.434           | 0.85 - 82.85        |
| Der p           | 7 (12.5%)                     | 6 (4%)                     | 0.047                | 3.429           | 1.09 - 10.69        |
| Der f           | 5 (8.9%)                      | 6 (4%)                     | 0.174                | 2.353           | 0.68 - 8.04         |
| Alternaria      | 6 (10.7%)                     | 5 (3.3%)                   | 0.073                | 3.480           | 1.01 - 11.90        |
| Asp fum         | 4 (7.1%)                      | 1 (0.6%)                   | 0.020                | 11.462          | 1.25 - 104.89       |
| tree pollen     | 2 (3.5%)                      | 1 (0.6%)                   | 0.180                | 5.519           | 0.49 - 62.09        |
| weed            | 13 (23.2%)                    | 14 (9.3%)                  | 0.018                | 2.937           | 1.28 - 6.72         |
| ash             | 6 (10.7%)                     | 8 (5.3%)                   | 0.213                | 2.13            | 0.70 - 6.44         |
| walnut          | 5 (8.9%)                      | 3 (2%)                     | 0.036                | 4.80            | 1.10 - 20.81        |
| willow          | 4 (7.1%)                      | 2 (1.3%)                   | 0.048                | 5.69            | 1.01 - 31.99        |
| poplar          | 1 (1.7%)                      | 1 (0.6%)                   | 0.471                | 2.709           | 0.16 - 44.06        |
| beech           | 2 (3.5%)                      | 1 (0.6%)                   | 0.180                | 5.519           | 0.49 - 62.09        |
| pine            | 5 (8.9%)                      | 0 (0%)                     | 0.001                | 0.911           | 0.83 - 0.98         |
| latex           | 2 (3.5%)                      | 0 (0%)                     | 0.073                | 0.964           | 0.91 - 1.01         |
| wheat           | 2 (3.5%)                      | 2 (1.3%)                   | 0.298                | 2.741           | 0.37 - 19.94        |
| cockroach       | 4 (7.1%)                      | 2 (1.3%)                   | 0.048                | 5.692           | 1.01 - 31.99        |

Der p, *Dermatophagoides pteronyssinus*; Der f, *Dermatophagoides farinae*; Asp fum, *Aspergillus fumigatus*; OR, odds ratio; CI, confidence interval. <sup>1</sup>Odds ratio chi square test.

working duration was 6.02 years (SD;  $\pm$  5.82, min - max 0.5 - 20 years).

Allergic symptoms were mainly reported by dog trainers. Of the dog trainers (n = 56), 35 (62.5%) reported ever having rhinitis, 13 (23.2%) reported skin symptoms, 7 (12.5) reported ever having conjunctivitis, 1 (1.7%) reported ever having asthma. 6 (10.7%) dog trainers reported work related symptoms. The distribution of symptoms according to the presence or absence of dog allergy is given in **table III**.

Of the dog trainers (n = 56), 37 (66%) were sensitized to at least 1 common allergen in skin prick test. Of the sensitized subjects (37 cases), 1 (1.7%) was sensitized only to dog allergen. Twelve subjects were sensitized to dog allergen. There was cat-feeding history in two participants' report. One of these participants had a positive SPT for cat. But no participant reported ever seeing dog in his or her homes. A summary of the skin prick test results of the subjects is given on **table II**.

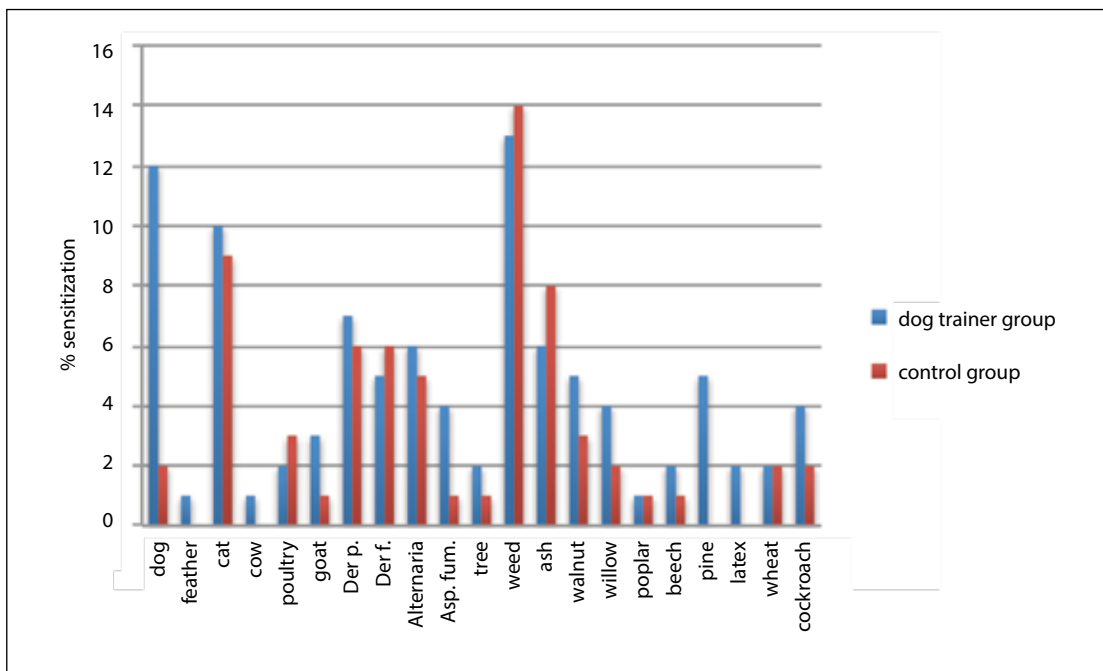
**Table II** and **figure 1** are showing the prevalence of positive skin prick test to common allergens in the dog trainer group and the control group. A positive SPT to dog was observed in 21.4% of dog trainers, whereas the frequency of sensitization to dog in the control group was 1.3% ( $p < 0.001$ , odds ratio OR 20.18, 95% CI 4.35 - 93.60). Dog allergy development risk is found 20 times greater for dog trainers than control group.

**Table III** is showing comparison of characteristics of the dog trainer with and without dog allergy. Contrary to expectation, there was no statistically significant difference between the subjects with and without family history of atopic disorders in terms of sensitization to dog. Only rhinitis symptom was statistically more significant in the subjects with sensitization to dog, while the other allergic symptoms were not. Reporting work-related allergic symptoms was related to positive skin prick test results to dog allergens by 83.3%. Two dog trainers with positive dog allergen SPT reported no clinical symptoms after exposure to dogs. There was no statistically significant difference between individuals with and without dog allergy in terms of accompanying allergy other than aspergillus fumigatus allergy.

#### Multiple logistic regression

A logistic regression was performed to ascertain the effects of age, smoking status, pet keeping, working duration, family history of atopic disorders and skin prick test positivity (against allergens other than the dog allergen) on the likelihood that dog trainers have dog allergy. The logistic regression model was statistically significant,  $p = 0.039$ . The model explained 37.0% (Nagelkerke  $R^2$ ) of the variance in the dog allergy, and correctly classified 85.7% of cases. Skin prick test positivity (against aller-

**Figure 1** - The rate of sensitization against 21 common allergens in dog trainer group and control group.



Der p, *Dermatophagoides pteromyssinus*; Der f, *Dermatophagoides farina*; Asp fum, *Aspergillus fumigatus*.

**Table III** - Comparison of the dog trainer with and without dog allergy in dog trainer group.

|   | Dog trainer group (56) |                        | p values                       |
|---|------------------------|------------------------|--------------------------------|
|   | dog allergy + (n = 12) | dog allergy - (n = 44) |                                |
| age, years ( $\pm$ SD)  | 32.08 $\pm$ 4.87       | 34.02 $\pm$ 6.71       | 0.355 <sup>1</sup>             |
| sex (male)  | 12 / 12                | 43 / 44                | 0.786 <sup>2</sup>             |
| <b>smoking</b>  |                        |                        |                                |
| current smokers, n (%)  | 2 (16.6%)              | 4 (9.0%)               | 0.599 <sup>2</sup>             |
| ex smokers, n (%)   | 3 (25.0%)              | 9 (20.4%)              | 0.734 <sup>3</sup>             |
| <b>pet seeing</b>   |                        |                        |                                |
| bird in the home  | 1 (8.3%)               | 3 (6.8%)               | 0.630 <sup>2</sup>             |
| cat in the home   | 1 (8.3%)               | 1 (2.2%)               | 0.386 <sup>2</sup>             |
| skin prick test positivity (another allergy from dog allergy) | 11 (91.6%)             | 25 (56.8%)             | <b>0.026</b> <sup>3</sup>      |
| family history of atopic disorders                            | 4 (33.3%)              | 13 (29.5%)             | 0.529 <sup>3</sup>             |
| working years, (mean $\pm$ SD)                                | 3.9 $\pm$ 4.94         | 6.6 $\pm$ 5.96         | 0.159 <sup>1</sup>             |
| <b>symptoms</b>   |                        |                        |                                |
| rhinitis  | 11 (91.6%)             | 28 (63.6%)             | <b>0.061</b> <sup>3</sup>      |
| rhinoconjunctivitis   | 0 (0%)                 | 7 (15.9%)              | 0.140 <sup>3</sup>             |
| allergic skin symptoms  | 2 (16.6%)              | 11 (25.0%)             | 0.544 <sup>3</sup>             |
| asthma  | 1 (8.3%)               | 0 (0%)                 | 0.214 <sup>2</sup>             |
| work related symptoms   | 10 (83.3%)             | 9 (20.4%)              | <b>&lt; 0.001</b> <sup>3</sup> |
| <b>SPT positivity, n (%)</b>                                  |                        |                        |                                |
| feather   | 0 (0%)                 | 1 (2.2%)               | 0.786 <sup>2</sup>             |
| cat   | 4 (33.3%)              | 6 (13.6%)              | 0.114 <sup>3</sup>             |
| cow   | 1 (8.3%)               | 0 (0%)                 | 0.214 <sup>2</sup>             |
| poultry   | 0 (0%)                 | 2 (4.5%)               | 0.614 <sup>2</sup>             |
| goat  | 1 (8.3%)               | 2 (4.5%)               | 0.522 <sup>2</sup>             |
| Der p   | 3 (25%)                | 4 (9.0%)               | 0.326 <sup>2</sup>             |
| Der f   | 3 (25%)                | 2 (4.5%)               | 0.060 <sup>2</sup>             |
| Alternaria  | 2 (16.6%)              | 4 (9.0%)               | 0.599 <sup>2</sup>             |
| Asp fum   | 4 (33.3%)              | 0 (0%)                 | <b>0.001</b> <sup>2</sup>      |
| tree pollen   | 0 (0%)                 | 2 (4.5%)               | 0.614 <sup>2</sup>             |
| weed  | 3 (25%)                | 10 (22.7)              | 0.869 <sup>3</sup>             |
| ash   | 3 (25%)                | 3 (6.8%)               | 0.105 <sup>2</sup>             |
| walnut  | 2 (16.6%)              | 3 (6.8%)               | 0.289 <sup>2</sup>             |
| willow  | 1 (8.3%)               | 3 (6.8%)               | 0.630 <sup>2</sup>             |
| poplar  | 0 (0%)                 | 1 (2.2%)               | 0.786 <sup>2</sup>             |
| beech   | 0 (0%)                 | 2 (4.5%)               | 0.614 <sup>2</sup>             |
| pine  | 2 (16.6%)              | 3 (6.8%)               | 0.289 <sup>2</sup>             |
| latex   | 0 (0%)                 | 2 (4.5%)               | 0.614 <sup>2</sup>             |
| wheat   | 1 (8.3%)               | 1 (2.2%)               | 0.386 <sup>2</sup>             |
| cockroach   | 0 (0%)                 | 4 (9.0%)               | 0.567 <sup>2</sup>             |

<sup>1</sup>Student t test; <sup>2</sup>Fisher's exact test; <sup>3</sup>Pearson chi square.

gens other than the dog allergen) was associated with dog allergy likelihood; age, smoking, cat keeping, bird keeping, working duration and family history of atopic disorders were not associated with dog allergy likelihood. The subjects with positive skin prick test against allergens other than the dog allergen were 27.81 times more likely to exhibit dog allergy than the subjects with negative skin prick test (95% CI 1.630 - 474.847,  $p$  0.022). Having pets other than the dog was not associated with positive skin prick test to dog (**table IV**).

## Discussion

This study aimed to reveal the prevalence rate of allergic diseases among police dog trainers by using skin prick test. It has been estimated that sensitization to dog confirmed by skin prick test can cause rhinitis, eczema and asthma (17). Skin prick testing (SPT) is informative and safe for detecting IgE-mediated allergen sensitization. No subject kept dogs at home in the past and current. For this reason, the potential confounder of keeping dog at home was excluded. Dogs were living always in the stations and trainers were not allowed to take dogs to their homes, and trainers were spending time with dogs only in the workplace. Thus, this study reflects the real effect of workplace exposure on the development of dog sensitivity. This is the first study investigating work-related symptoms and allergic sensitivity in dog trainers.

**Table IV** - Multivariate analysis (logistic regression) of factors for development of sensitization to dogs.

| Risk factor   | OR     | 95% CI          | p value      |
|---|--------|-----------------|--------------|
| age   | 0.91   | 0.734 - 1.149   | 0.458        |
| smoking   | 0.50   | 0.020 - 12.415  | 0.674        |
| working duration  | 1.17   | 0.918 - 1.503   | 0.201        |
| pet seeing  |        |                 |              |
| bird in the home  | 14.417 | 0.367 - 565.830 | 0.154        |
| cat in the home   | 0.624  | 0.013 - 30.060  | 0.812        |
| family history of atopic disorders                                | 0.35   | 0.062 - 2.002   | 0.239        |
| skin prick test positivity (another allergy from the dog allergy) | 27.81  | 1.630 - 474.847 | <b>0.022</b> |

OR, odds ratio; CI, confidence interval.

In this study it was found that sensitization to dog allergens was higher among dog trainers (21.4%) than control group (1.3%). Krakowiak et al. found allergies to animals (dog, cat, rat, mouse, rabbit, guinea pig and hamster) in 26% of zoo workers (18). In many studies, it has been determined that animal workers have an increased risk of animal allergy (11,15,19,20). Current study recommend that police dog trainers should also be accepted as animal workers in terms of allergy because they spend nearly all of their work time with dogs. Airborne dog allergens can be deposited in the workplace (21). Additionally, dog saliva is an allergen source for dog allergy. There is variability between the IgE-binding protein profiles of saliva from different dogs (22). It has been found there are at least 12 protein bands in dog saliva that can be recognized by IgE of dog-allergic patients. Also, it has been determined that there is a great variation in the IgE-binding profile, when investigating saliva from different dog breeds. On account of this, contact with many dogs and different breed dogs can increase the likelihood of allergy.

Other than dog allergies, weed was the allergen with the highest prevalence of sensitization among the dog trainers. Frequency of sensitization to weed differed significantly between dog trainers and controls (23.2% versus 9.3%). Also, sensitization to cat, *Dermatophagoides pteronyssinus*, *Aspergillus fumigatus*, walnut, willow, pine, and cockroach were significantly more frequent in dog trainers than controls (**table II**). Allergenic cross-reactivity between dog and cat was explored (23). An increased risk of sensitization to dogs 20.1-fold, to *Dermatophagoides pteronyssinus* 3.4-fold, and to *Aspergillus fumigatus* 11.4-fold was found in dog trainers group. There are also endotoxin or other microbial agent exposures from dogs. It has been found that mites feed on animal scales, so sensitization to mite allergens may be due to occupational factors (21). Also, dog trainers had a 4.8-fold increased risk of sensitization to walnut, a 5.6-fold increased risk of sensitization to willow. Dog trainers may come in contact with these allergens at work. The important question at this point is whether the results of dog exposure specifically influence only the risks of dog allergy, or the risks of allergy to multiple allergens. This study has been conducted in a country with a low pet-keeping rate. In this country, it has been found that dog allergen exposure due to passive transport is a less important problem than in countries with high pet-keeping ratios (16). Therefore, it was thought that results reflect the real effect of workplace exposure.

It was observed that the prevalence of rhinitis in dog trainers was higher than in the control group. Respiratory, skin and eye symptoms were found similar between study and control groups, although it was found that sensitization to dog allergen in 21.4% work-related symptoms was declared in 33.9% of dog trainers. Nineteen animal workers with allergy symptoms had negative animal allergen SPT. Symptom and atopy rates were

quite high, while sensitivity to animal allergens was less than expected. Negative skin tests in symptomatic individuals may be due to non-IgE mediated mechanisms. Dog trainers reported frequent work-related symptoms in this study. Dog trainers have close contact with dogs; also, dogs contain high levels of allergens such as mite and fungal allergens. Because of this, work-related symptoms may have occurred more frequently. So, dog trainers are exposed to a variety of allergens, which constitute a risk factor for allergic sensitization and symptoms. The presence of work-related symptoms could be explained by exposure to other allergens or non-specific irritants in the workplace. Two dog trainers with sensitization to dog (by using skin prick test) reported no clinical symptoms after exposure to dogs. Similarly, in a laboratory workers study, it has been found that sensitization rates were 12.7% and 16.3% in those exposed to mice and rats, respectively, and work-related complaints occurred in 33.7% and 37.8% of employees (24).

The multivariate logistic regression analysis revealed a significant role of skin prick test positivity (against allergens other than the dog allergen) associated with dog allergy likelihood. Age, smoking, working duration, pet seeing and family history of atopic disorders were found not an independent risk factor for the development of sensitization to dogs. Although there weren't pre-employment SPT of workers, it has been asserted that skin prick test positivity is associated with atopy. Of the sensitized subjects (37 cases), 1 (1.7%) was sensitized only to dog allergen. In a study about occupational allergy, it was found that other factors associated with atopy, such as having a positive skin test response for house dust mite or pollen and a number of positive allergy test results, likewise showed positive associations with occupational sensitization to laboratory animals (25).

Risk factors for developing allergic sensitization to dogs have not been fully elucidated. The main risk factor for the development of laboratory animal allergy was identified to be atopy (15,26). Atopic subjects were found to be up to 12 times more likely to have laboratory animal allergy. In the multivariate logistic regression analysis, having a positive skin prick test created an increase in the odds by a factor of 27.8 (95% CI 1.6 - 474.8). In other words, in our study, subjects with positive SPT have 27.8 times higher risk of dog allergy.

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The key question is how can we predict the risk of developing dog allergy after exposure. Although atopy appears to be the main risk factor for occupational allergy, establishing atopy is generally considered inadequate for pre-employment selection, because atopy is common in industrialized countries (27). The algorithm defined by Liccardi and colleagues can be used to detect the susceptible subjects to dog allergy before working with dogs (28,29). In that algorithm, it was suggested that subjects should be evaluated by SPT, specific IgEs and further molecular diagnosis. That molecular diagnosis is done by evaluation of specific IgEs using micro-array technique for lipocalins and albumins, and gives opportunity to evaluate the possibility of cross-reactions between allergens of different animals. Atopic individuals should be identified pre-employment, and screening and counseling should be applied periodically. Prevention programs as legal requirements should base on medical check-ups. These check-ups should include questionnaires and medical examination. Also, education, engineering controls, administrative controls should be made. Work practices should be planned to minimize allergen exposure. Regular washing of the pet, use of denaturants for reservoirs, HEPA air filtration, and regular vacuuming may reduce risk of sensitization by lowering allergen loads.

Selecting hypoallergenic dog breeds as police dogs can be the solution of this occupational health problem but previous studies have been reported that there is no dog breed that can be considered as hypoallergenic (30,31).

Further studies will be needed, to clarify whether working with different breed dogs increases the risk of allergies. Longitudinal studies are needed for determining all of risk factors. This study is the first study to investigate the presence of sensitization to dogs and common allergens in police dog trainers.

## Conclusions

Current study indicates that allergic disease is a serious occupational health concern for police dog trainers. Dog trainers are exposed to a variety of different breed dogs that may constitute a risk factor for allergic sensitization and symptoms.

## Conflict of interest

The authors declare that they have no conflict of interest.

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