



ORIGINAL ARTICLE

Occupational Dog Allergy among Police Dog Trainers

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Abstract

Objectives: Occupational allergy is an important health problem. This study was aimed to reveal the prevalence of dog allergy and other common allergy and allergic symptoms in police dog trainers.

Methods: 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. To predict skin prick test (SPT) positivity to dog allergen, binary logistic regression was used for multivariate analysis of all potential predictors associated with sensitization to dog.

Results: 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% ($p < 0.001$, odds ratio [OR] = 20.18, 95% CI 4.35-93.60). Dog allergy development risk is found 20 times greater in dog trainers than control group. In multiple logistic regression analysis it was found that SPT positivity (other than dog allergy) 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.

Conclusions: This is the first study investigating the presence of sensitization to dogs and common allergens in police dog trainers. Sensitization to dog allergens is an important occupational problem for dog trainers. Precautions should be taken to prevent the development of dog allergy in this profession group.

Keywords

Animal allergy, Dog allergy, Occupational allergy, Atopy, Skin prick test

Abbreviations

SPT: Skin Prick Test; OR: Odds Ratio; CI: Confidence Interval

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].

It was determined that seventy percent 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. Also we 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/Patients 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 are compared with the medical records of control group. The study was approved by local ethic committee and written informed consent was obtained from all participants. There were no subjects that have 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 of animal contact, occupational and nonoccupational 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. It was considered that symptoms 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). Test was 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 1](#).

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: ± 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 2](#).

Table 1: Characteristics of the study population.

	Dog trainer group (n = 56)	Control group (n = 150)	p
Characteristics of the population			
Age (y), mean \pm SD (min-max)	33.6 \pm 6.37 (25-52)	33.18 \pm 14.83 (18-75)	0.835*
Sex (female/male)	1/55	10/140	0.295**
Data from clinical history			
Smoking, yes (%)	6 (10.7%)	32 (21.3%)	0.080**
Ex-smoker	12 (21.4%)	44 (29.3%)	0.257**
Family history of atopy, n (%)	17 (30.3%)	31 (20.61%)	0.143**
Time of dog work, year \pm SD (min-max)	6.02 \pm 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**
Cat in the home	2 (3.5%)	12 (8.0%)	0.261*
Allergic symptoms			
Rhinitis	39 (69.6%)	44 (29.3%)	< 0.001**
Rhinoconjunctivitis	7 (12.5%)	15 (10%)	0.605**
Allergic skin symptoms	13 (23.2%)	19 (12.6%)	0.063**
Asthma	1 (1.7%)	6 (4%)	0.435**
Work related symptoms	19 (33.9%)	0 (0%)	< 0.001**

*Student t test, **Pearson Chi-Square test.

Table 2: The comparison of dog trainer group and control group in terms of the results of SPT.

Skin prick test	Dog trainer group (n = 56)	Control group (n = 150)	p value*	OR*	95% CI*
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. *Odds ratio Chi-Square Test.

Dog trainer group characteristics

Fifty-six dog trainers 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

Table 3: 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*
Sex (male)	12/12	43/44	0.786**
Smoking			
Current smokers, n (%)	2 (16.6%)	4 (9.0%)	0.599**
Ex-smokers, n (%)	3 (25.0%)	9 (20.4%)	0.734***
Pet seeing			
Bird in the home	1 (8.3%)	3 (6.8%)	0.630**
Cat in the home	1 (8.3%)	1 (2.2%)	0.386**
Skin prick test positivity (another allergy from the dog allergy)	11 (91.6%)	25 (56.8%)	0.026***
Family history of atopic disorders	4 (33.3%)	13 (29.5%)	0.529***
Working years, (mean \pm SD)	3.9 \pm 4.94	6.6 \pm 5.96	0.159*
Symptoms			
Rhinitis	11 (91.6%)	28 (63.6%)	0.061***
Rhinoconjunctivitis	0 (0%)	7 (15.9%)	0.140***
Allergic skin symptoms	2 (16.6%)	11 (25.0%)	0.544***
Asthma	1 (8.3%)	0 (0%)	0.214**
Work related symptoms	10 (83.3%)	9 (20.4%)	< 0.001***
SPT positivity, n (%)			
Feather	0 (0%)	1 (2.2%)	0.786**
Cat	4 (33.3%)	6 (13.6%)	0.114***
Cow	1 (8.3%)	0 (0%)	0.214**
Poultry	0 (0%)	2 (4.5%)	0.614**
Goat	1 (8.3%)	2 (4.5%)	0.522**
Der p.	3 (25%)	4 (9.0%)	0.326**
Der f.	3 (25%)	2 (4.5%)	0.060**
Alternaria	2 (16.6%)	4 (9.0%)	0.599**
Asp. fum.	4 (33.3%)	0 (0%)	0.001**
Tree pollen	0 (0%)	2 (4.5%)	0.614**
Weed	3 (25%)	10 (22.7)	0.869***
Ash	3 (25%)	3 (6.8%)	0.105**
Walnut	2 (16.6%)	3 (6.8%)	0.289**
Willow	1 (8.3%)	3 (6.8%)	0.630**
Poplar	0 (0%)	1 (2.2%)	0.786**
Beech	0 (0%)	2 (4.5%)	0.614**
Pine	2 (16.6%)	3 (6.8%)	0.289**
Latex	0 (0%)	2 (4.5%)	0.614**
Wheat	1 (8.3%)	1 (2.2%)	0.386**
Cockroach	0 (0%)	4 (9.0%)	0.567**

*Student t test, **Fisher's Exact Test, ***Pearson Chi-Square.

(SD: \pm 6.37, min-max: 25-52 years). The current smoking rate was 10.7%. The mean working duration was 6.02 years (SD: \pm 5.82, min-max: 0.5-20 years).

Dog trainers mainly reported allergic symptoms. Reported allergic symptoms were rhinitis in 35 (62.5%) subjects, skin symptoms in 13 (23.2%) subjects,

conjunctivitis in 7 (12.5) subjects and asthma in 1 (1.7%) subject. 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 the [Table 3](#).

Of the dog trainers (n = 56), 37 dog trainers (66%)

were sensitized to at least 1 common allergen in skin prick test. Twelve subjects were sensitized to dog allergen and one of them was sensitized just only to dog allergen. 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 the Table 2.

Table 4 and Figure 1 are showing the prevalence of positive skin prick test to common allergens in two groups. Positive SPT to dog was 21.4% and 1.3% in dog trainer and control group respectively ($p < 0.001$, 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 3 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 significantly more in the subjects with sensitization to dog. 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 (another allergy from the dog allergy) on

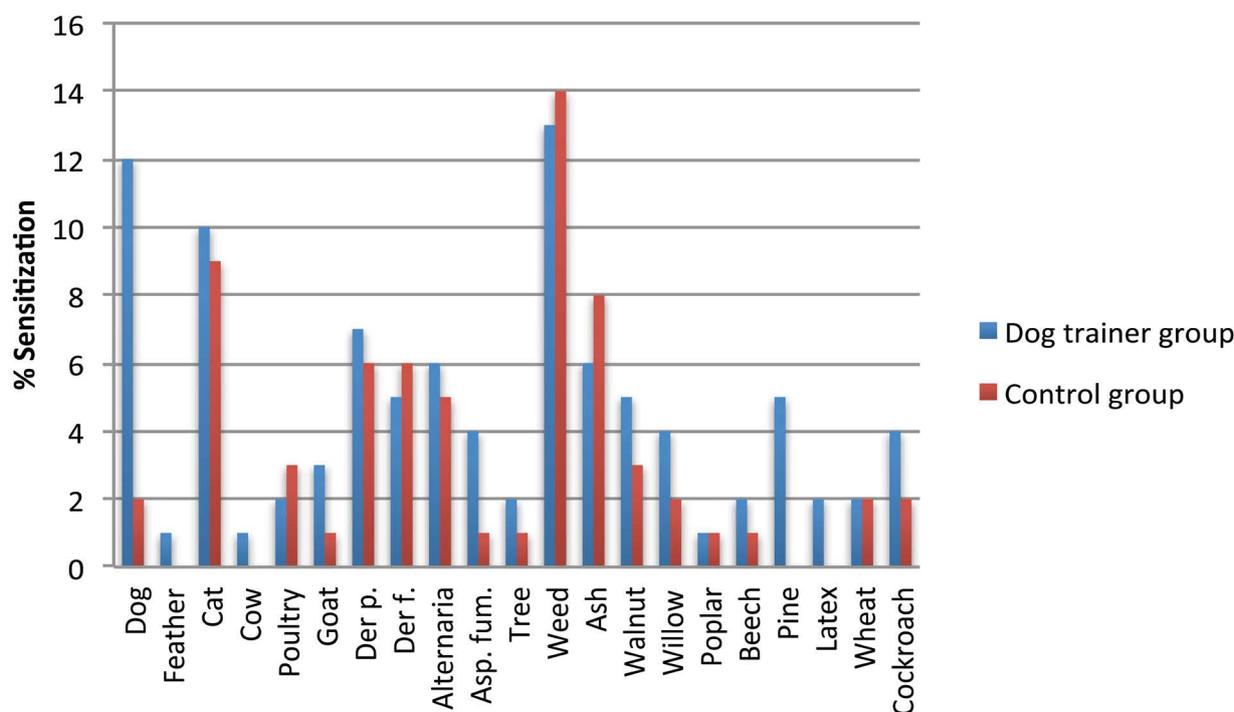


Figure 1: The rate of sensitization against 21 common allergens in dog trainer group and control group. Der p: *Dermatophagoides pteronyssinus*; Der f: *Dermatophagoides farinae*; Asp. fum: *Aspergillus fumigates*.

Table 4: 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	0.022

OR: Odds ratio; CI: Confidence interval.

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 (another allergy from the dog allergy) 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 skin prick test positivity another from dog allergy were 27.81 times more likely to exhibit dog allergy than the subjects with skin prick test negativity. (95% CI 1.630-474.847, $p = 0.022$) Having pets different from dog was not associated with positive skin prick test to dog.

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, a potential confounder that keeping dog at home was excluded. 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.

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 animal (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 2). Allergenic cross-reactivity between dog and cat was explored [23]. It was found that increased risk of sensitization to dogs 20.1-fold, to *Dermatophagoides pteronyssinus* 3.4-fold, and to *Aspergillus fumigatus* 11.4-fold in dog trainers group. There are also endotoxins 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 contact to these allergens at work. The important question at this point is that 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 in countries with low 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 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 were declared in 33.9% of dog trainers. Nineteen animal workers with allergy symptoms had negative animal allergen SPT. While symptom and atopy rates were quite high, 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 be 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% exposed to mice and rats, respectively, and work-related complaints occurred in 33.7% and 37.8% of employees occupationally [24].

The multivariate logistic regression analysis revealed a significant role of skin prick test positivity (another allergy from the dog allergy) was associated with dog allergy likelihood. Age, smoking, working duration, pet seeing and family history of atopic disorders found not an independent risk factor for the development of sensitization to dogs. Although there aren'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 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.

Key question is that 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]. However atopic individuals should be identified pre-employment, 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 educations, 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.

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.

In conclusion, study data indicate that allergic disease is a serious occupational health concern for police dog trainers. Dog trainers are exposed to a variety of different breed dogs which may constitute a risk factor for allergic sensitization and symptoms.

Funding

There is no financial support used for this study.

Conflict of Interest

The authors declare that they have no conflict of interest.

Clinical Trial Registration

Keçiören Training and Research Hospital Ethical Committee (Approval number: B.10.4.ISM.4.06.68.49).

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