

Sensitization to horse hair, symptoms and lung function in grooms

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Summary

Objective This study aimed to investigate the rate of occupational sensitization to horse hair in grooms and whether occupational exposure to horse hair increases respiratory and allergic symptoms and affects lung function in grooms or not.

Methods This is a cross-sectional study. Two hundred grooms were randomly selected among 1000 grooms working in Veliefendi Hippodrome of Istanbul. One hundred and twenty-five subjects agreed to enter the study. Ninety-two workers who worked in the different parts of this hippodrome enrolled as the control group. A detailed questionnaire including respiratory and allergic symptoms was filled in, physical examination, skin prick tests and pulmonary function tests were performed.

Results Sensitization to horse hair was 12.8% in grooms and 4.3% in controls. The difference was statistically significant ($P=0.0035$). Asthma was found in 14.4% of the grooms and 5.4% of the controls, allergic rhinitis in 42.4% of the grooms and 18.4% of the controls, allergic conjunctivitis in 35.2% of the grooms and 15.2% of the controls, and allergic skin diseases in 32.8% of the grooms and 13% of the controls. The differences were statistically significant ($P=0.043$, $P=0.0002$, $P=0.001$ and $P=0.0008$, respectively). The means of FEV₁, FEV₁/FVC and FVC parameters were significantly lower in the groom group ($P=0.006$, $P=0.001$ and $P=0.003$, respectively). In the multivariate analysis, being in the groom group and working years were found to be predictive factors for impairments of lung function ($P<0.001$ and $P=0.002$, respectively).

Conclusion Occupational exposure to horse increases the sensitization to horse hair, induces asthma and allergic symptoms and also impairs lung functions.

Keywords asthma, groom, horse hair, occupational allergy, pulmonary function, rhinoconjunctivitis

Submitted 3 September 2001; revised 30 October 2001; accepted 29 March 2002

Introduction

Horse hair has a strong allergenicity [1, 2] and horse allergy is an important problem in a young urban population [2, 3]. On exposure, horses can cause a wide range of clinical symptoms from urticaria to respiratory distress in sensitized individuals [2–4]. It was shown as early as 1918 that flare-ups of atopic disease occurred on exposure to horse dander [5].

An association between occupation and development of allergy has been shown for several professions [6]. Earlier studies have shown that allergic disorders may occur secondary to occupational exposure of farmers and veterinarians to horses [4, 7]. However, apart from case reports of horse hair allergy [2, 3], we couldn't find any detailed report about occupational sensitization to horses or allergic disorders in grooms.

Methods

This is a cross-sectional study. Two hundred grooms were randomly selected among 1000 grooms working in the

Veliefendi Hippodrome in Istanbul. One hundred and twenty-five agreed to enter the study. Ninety-two control subjects were selected among people in the hippodrome territory who had no direct contact with horses and worked away from stables (ticket seller, etc.).

Subjects who received immunotherapy for any mites or pollens were not included in the study. A detailed questionnaire including respiratory and allergic symptoms was filled in, and physical examination, skin prick tests and pulmonary function tests were performed.

We developed a detailed questionnaire by modifying a previous questionnaire in the literature [8]. This questionnaire included data on respiratory and allergic symptoms, demographic factors, tobacco use, allergen exposures, medication use, work environment, working years, dwelling and living status.

Asthma was considered to be present in subjects with a history of episodic shortness of breath, wheezing and breathing difficulties [7]. Allergic rhinitis (seasonal or perennial) was defined as episodic rhinorrhea, usually associated with nasal stuffiness and sneezing, and allergic conjunctivitis was defined as itchiness and lacrimation in response to known or suspected allergen [7]. Allergic skin diseases were considered to be present in subjects with a history of allergic urticaria or atopic eczema/dermatitis [5, 9].

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We accepted subjects who had been smoking for at least 1 month as current smokers, those who had not smoked for at least 1 month as ex-smokers and those who smoked one or less than one cigarette a day as non-smokers.

Skin prick tests were performed on the volar side of one forearm according to the recommendations of the Subcommittee on Skin Tests of the European Academy of Allergy and Clinical Immunology. The grading system was based on the relation between the reactions induced by allergen and histamine reference [10]. The allergens used together with histamine hydrochloride (10 mg/mL) and glycerol diluent controls were provided by Stallergenes S.A., Paris, France, at concentrations of 1/10 IR (index of reactivity) for *D. farinea* and *D. Pteronyssinus*, 1/20 IR for grasses, cereals, trees and weeds, 1/10 IC (index of concentration) for horse hair, and 100 IR for cat, dog and animal epithelia.

Lung function tests with were performed with Medic-air plus (QRS Diagnostics, Plymouth, MN, USA)

Statistical analyses

Data analyses and descriptive statistics were performed with the statistical package for the social sciences (SPSS 9.05). Chi-squared tests were used to compare the differences in the characteristics of two groups. Four separate logistic regression analyses were performed to analyse the risk factors for horse hair sensitization, asthma, allergic rhinoconjunctivitis and skin complaints. Dependent variables and covariates used in these logistic regression analyses are shown in Tables 2 and 3.

Student's *t*-test was used for the comparison of lung function parameters between two groups. Then, multivariate ANOVA was performed to analyse the predictive factors for impairment of lung function parameters. In the multivariate analysis model, we used FEV₁%, FEV₁/FVC, FVC% and FEF₂₅₋₇₅%

parameters as dependent variables, age, working years and tobacco use as covariates and being in the groom group as a factor.

P-values less than 0.05 were considered to be statistically significant.

Results

One hundred and twenty-five male grooms in the study group (age range 16 to 70 years) and 92 male subjects (age range 15–60 years) in the control group participated in this survey; 62.5% of the randomly chosen grooms agreed to participate. Some characteristics, skin test results and clinical diagnoses of workers are shown in Table 1.

Logistic regression analysis showed that:

- The risk of the sensitization to horse hair was increased 8.95-fold in subjects who have a sensitization to an animal epithelia compared with subjects without a sensitization to an animal epithelia (Table 2).
- The risk of the sensitization to horse hair was increased 3.75-fold in the grooms compared with the control group (Table 2).
- Sensitization to horse hair appeared to increase the risk of asthma 4.5-fold (Table 3).
- The grooms had a 1.8-fold increased risk of allergic rhinitis compared with the controls. (Table 3).
- The grooms had a 3.9-fold increased risk of allergic conjunctivitis compared with the controls (Table 3).
- The grooms had a 3.25-fold increased risk of allergic skin diseases compared with controls (Table 3).

The means of FEV₁, FEV₁/FVC and FVC parameters were significantly lower in the groom group. The means of PFT parameters are listed in Table 4. FEV₁ and FEV₁/FVC were

Table 1. Some characteristics, skin test results and clinical diagnoses of workers

	Study group (<i>n</i> = 125)	Control group (<i>n</i> = 92)	<i>P</i> -value
Age (mean ± SD)	36.7 ± 11.7	34.4 ± 9.2	NS
Working years (mean ± SD)	17.4 ± 10.3	11 ± 7	< 0.001
Smoking			
Current smoker	85 (68%)	67 (72.8%)	NS
Ex-smoker	9 (7.2%)	6 (6.5%)	NS
Non-smoker	31 (24.8%)	19 (20.7%)	NS
Prick test positivity			
Horse hair	16 (12.8%)	4 (4.3%)	0.035
Animals epithelia	6 (4.8%)	4 (4.3%)	NS
Mite	7 (5.6%)	7 (7.6%)	NS
Pollen	14 (11.2%)	10 (10.9%)	NS
Asthma	18 (14.4%)	5 (5.4%)	0.043
Physician-diagnosed asthma	7 (5.6%)	3 (3.2%)	NS
Worsening or improving of symptoms at/off work	12 (9.6%)	2 (2.1%)	0.046
Current use of asthmatic medication	6 (4.8%)	4 (4.3%)	NS
Family history of asthma	5 (4%)	4 (4.3%)	NS
Allergic rhinitis	53 (42.4%)	17 (18.4%)	0.0002
Physician-diagnosed allergic rhinitis	16 (12.8%)	8 (8.6%)	NS
Allergic conjunctivitis	44 (35.2%)	14 (15.2%)	0.001
Physician-diagnosed allergic conjunctivitis	10 (8%)	6 (6.5%)	NS
Allergic skin diseases	41 (32.8%)	12 (13%)	0.0008
Physician-diagnosed allergic skin disease	12 (9.6%)	5 (5.4%)	NS

Table 2. Odds ratios (OR) indicating association of sensitization to horse hair with tobacco use, working years, sensitization to mites, sensitization to pollens, sensitization to animal epithelia and being in the grooms group

Risk factors	Sensitization to horse hair	
	OR (95% CI for OR)	P
Tobacco use	1.37 (0.65–2.9)	NS
Working years	0.03 (0.0–9.37)	NS
Sensitization to mites	1.1 (0.16–7.78)	NS
Sensitization to pollens	3.1 (0.94–69.2)	NS
Sensitization to animal epithelia	8.95 (1.96–40.75)	0.0046
Being in the grooms group	3.75 (1.1–12.82)	0.034

Logistic regression analysis (with forward LR method). If confidence interval (CI) does not include 1.0, result is significant at $P < 0.05$.

Table 3. Odds ratios (OR) indicating association of asthma, allergic rhinitis, allergic conjunctivitis and allergic skin complaints with tobacco use, working years, sensitization to mites, sensitization to pollens, sensitization to horse hair and being in the grooms group

Risk factors	Asthma		Allergic rhinitis		Allergic conjunctivitis		Allergic skin complaints	
	OR (95% CI for OR)	P	OR (95% CI for OR)	P	OR (95% CI for OR)	P	OR (95% CI for OR)	P
Tobacco use	0.8 (0.4–1.5)	NS	0.8 (0.5–1.2)	NS	1.06 (0.7–1.6)	NS	0.7 (0.5–1.2)	NS
Working years	0.0 (0.0–4.7)	NS	1.1 (0.0–6.2)	NS	1.3 (0.0–7.5)	NS	0.0 (0.0–3.8)	NS
Sensitization to mites	3.5 (0.5–25.4)	NS	1.4 (0.4–5.3)	NS	2.7 (0.7–10)	NS	5.8 (1.2–27.5)	NS
Sensitization to pollens	0.5 (0.1–3.4)	NS	1.3 (0.4–4)	NS	2.0 (0.6–6.5)	NS	0.18 (0.03–0.9)	NS
Sensitization to animal epithelia	4.3 (0.4–44.2)	NS	3.1 (0.5–17.4)	NS	1.13 (0.2–6.3)	NS	0.48 (0.03–5.8)	NS
Sensitization to horse hair	4.5 (1.5–13.3)	0.006	1.5 (0.4–5.1)	NS	1.5 (0.4–5.4)	NS	2.4 (0.6–9.8)	NS
Being in the grooms group	2.1 (0.6–7.3)	NS	1.8 (1.0–3.1)	0.03	3.9 (2.0–7.5)	0.000	3.25 (1.6–6.6)	0.012

Logistic regression analysis (with forward LR method). If confidence interval (CI) does not include 1.0, result is significant at $P < 0.05$.

less than 80% of the predicted values in 30 (24%) of the grooms and in 14 (15.2%) of the controls. After categorization to symptoms, 6 (33.3%) of the grooms with asthma had a FEV₁ and a FEV₁/FVC below 80% of the predicted values.

In the multivariate analysis model, being in the groom group and working years were found to be predictive factors for impairments of lung function ($P < 0.001$ and $P = 0.002$, respectively).

Discussion

This study showed that occupational exposure to horse hair increases the sensitization to horse hair, induces asthma and allergic disorders and also impairs lung functions.

A considerable interest has been generated in the role of animal danders as inhalant allergens in atopic disease and asthma [11–13]. Horse hair has a strong allergenicity and may be responsible for asthma [1, 2]. It has been reported that horse allergy can cause a wide range of clinical symptoms, from urticaria to respiratory distress, in sensitized individuals [2–4]. It has also been reported that horse hair dander can play a major part in childhood asthma within an urban environment [2].

Table 4. The means of pulmonary function parameters in the study and control groups

Parameter	Study group	Control group	P-value*
FVC%	91.9 + 19	99.3 + 16.3	0.003
FEV ₁ %	85.9 + 20.9	92.8 + 12.3	0.006
FEV ₁ /FVC	83.7 + 9.8	90 + 15.9	0.001
FEF _{25–75} %	78.2 + 32.3	80.5 + 20.1	0.5

*Significant if $P < 0.05$ for Student's *t*-test.

We found that asthma, allergic rhinitis, allergic conjunctivitis and allergic skin diseases were higher in grooms than in the controls. Asthma was found in 14.4%, allergic rhinitis in 42.4%, allergic conjunctivitis in 35.2% and allergic skin diseases in 32.8% of the grooms according to the questionnaires. Grooms had 1.8-fold increased risk of allergic rhinitis, 3.9-fold increased risk of allergic conjunctivitis and 3.25-fold increased risk of skin diseases. Additionally, sensitization to horse hair appeared to increase 4.53-fold the risk of asthma. Our results confirm that horse hair is an important allergen for asthma.

Several factors contribute to the development of occupational asthma and allergies [6]. It was shown that cumulative duration of exposure to domestic animals (for example to horses) was a significant determinant for immediate sensitization to animal-derived antigens in subjects with asthma [11]. Our results showed that risk of sensitization to horse was increased 3.75-fold if subjects had an exposure to horse hair in the workplace. Therefore, we thought that horse hair had a high allergenic potential, especially when close contact is established. We did not find duration of exposure to horses to be a risk factor for sensitization to horse hair in logistic regression analysis.

Certain host factors also contribute to the development of occupational asthma and allergies. Smoking has been shown to

increase the development of some sensitivities [6, 14]. In our study smoking did not appear to increase the risk of sensitization to horse hair.

We could not find a large study in the literature dealing with pulmonary functions in workers occupationally exposed to horse hair. We found that pulmonary functions (FEV₁, FEV₁/FVC and FVC) were significantly impaired in the grooms group compared with controls. The association of reduced FEV₁ with asthma primarily represents a manifestation of the disease [7]. After categorization to symptoms, we found that the proportion of asthmatic grooms with reduced FEV₁ was 33.3%.

Additionally, multivariate analysis showed that being in the grooms group induced impairments in lung functions. Number of working years was also found to be another predictive factor for impairments in lung functions.

Horse hair antigens have a high allergenicity. Horse hair albumin, an allergenic component of horse hair, bound a high percentage of albumin-specific IgE [15]. Animal hair/dander proteins, among which albumins are possible cross-sensitizing allergenic components, frequently cause type 1 allergic symptoms and severe asthma [15–17]. IgE cross-reactivities against albumins were reported in patients allergic to dog, cat and horse [15]. In addition, RAST inhibitions indicated shared IgE epitopes between deer, cow and horse allergens [13, 15–17]. Cow danders are very antigenically related to horse danders [16] and cow danders are reported to be an important cause of occupational asthma in Finland [18].

Some patients who are allergic to horses have reported that they can tolerate certain breeds, and the presence of breed-specific allergens has been suggested. Felix et al. found considerable interbreed and within-breed variation but no breed-specific allergens [19]. IgE-binding antigens in horse dander and a mixture of horse hair and skin scrapings have been compared in a study by Fjeldsgaard et al. and they showed the presence of mainly the same IgE-binding antigens in the two extracts [1]. In this study, we found significantly more skin test reactivity to any animal feathers in subjects who had a sensitization to horse hair and we thought that this may be due to cross-reactivity.

One of the limitations of this survey was the lack of measurements of specific IgE to horse hair. However, considering the methodology used in the diagnosis of sensitization, i.e. skin prick tests and measurements of IgE, it seems evident that skin prick tests provide more reliable results for different allergens [20]. Therefore, we think that our sensitization rates are highly reliable.

Another limitation of this study is the low participation rate of grooms; 62.5% of the randomly chosen grooms agreed to participate. It is likely that grooms with symptoms would have volunteered more readily than those without. Such selection bias may have distorted the results. On the other hand, grooms may have not been willing to participate because they might worry that possible stigmatization with a health problem would cause problems related to their job. This may be a cause of the low participation rate.

In conclusion, horse hair has a high allergenic potential, especially when a close contact is established. In this kind of contact, occupational allergic sensitization to horse hair was significantly associated with asthma and allergic disorders in grooms. In addition, exposure to horse hair in the workplace

may not only be associated with allergic sensitization, but also induce impairments in lung function.

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