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Decreased Sensitization to Aeroallergens among Southwestern Iranian Male Farmers

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ABSTRACT

Farmers are usually exposed to various inhaled allergens like pollens, mites, molds, and animal dander in their working environment which may lead to allergic rhinitis, asthma and urticaria. The purpose of this study was to identify sensitization to various aeroallergens in farmers and their occupational allergy symptoms.

This cross sectional study included 103 male farmers and 100 non-farmer healthy controls. The work-related symptoms of farmers were recorded with a questionnaire. Spirometry and skin prick tests with 15 commercial allergen extracts were performed in both farmers and controls.

The rate of sensitization to at least one of the applied aeroallergens was 47.6% in farmers compared to 65% in the control group (OR=0.48; CI 95%, 1.08 to 2.07) according to skin prick tests, after adjusting for age. Occupational allergy symptoms were reported by 54.3% farmers. Mean FEV_1/FVC was significantly lower in farmers than in controls ($p<0.001$).

The results of this study showed that farmers had no increased risk of sensitization to aeroallergens. Sensitization to pollens was more prevalent than to mites among the farmers in our study and smoking was an important predisposing factor in farmers who suffered from occupational allergy symptoms.

Keywords: Farmers; Lung function; Mite; Pollen; Skin test; Workplace

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INTRODUCTION

Working in a farm is associated with daily exposure to pollens, mites, molds and animal dander.

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Farmers are exposed perennially to high pollen concentrations released from trees, weeds and grasses.[1] Mites including house dust and storage mites are the most prevalent allergens leading to sensitization in farmers.[2] Among allergenic mold spores, hypersensitivity to Aspergillus is common in farmers.[3,4] Animals and animal related exposures remain important triggers for wheeze among adult farmers.[5]

The old belief considered that farmers are at a high risk of occupational allergy and respiratory diseases,[6,7] but recent reports have drawn attention to protective effect of farming against atopy and asthma.[8,9] Therefore, the evidence of the risk of atopy and asthma in adult farmers is still unclear.

During the last decades, different studies noted respiratory system involvement from parenchymal damage to other respiratory diseases in relation to farming exposures. Efforts have also been focused on measurements of lung function among farmers,[10] it is reported that long-term exposure to grain dust and other substances results in progressive loss in lung function.[11]

This study was conducted to determine sensitization to farms' common allergens, occupational allergy symptoms and lung volume in farmers.

MATERIALS AND METHODS

All participants were farmers who had worked at the farms in Fars province, southwestern Iran for at least 2 years. They had exposure to beet, corn, onion, potato, rye, rice, tomato, and wheat. The study was conducted during summer 2015 when the temperature was between 20-38ºC and the humidity of the workplace varied from 13% to 47%. Participants with upper respiratory tract infection, cardiovascular diseases, and individuals who were under treatment with antihistamines were excluded. 100 non-farmer healthy males were selected randomly from the same geographic area as control group. After approval of the study protocol by the Ethics Committee of our university (No. IR.SUMS.REC.1394.S436), informed consent was obtained from each participant in both groups.

Demographic information of participants including age, height, weight, and a complete record of job was collected.

Clinical data including symptoms of the respiratory system, nose and skin were collected by interview.

Cough, wheezing and shortness of breath were considered as pulmonary symptoms; rhinorrhea, sneezing and nasal congestion as allergic rhinitis; itchy skin rash and urticaria as skin symptoms. Symptoms were considered work-related if they first appeared after the worker began his job at the farm. A complete record of smoking habits was obtained, and each person who smoked at least one cigarette daily for a year was classified as a smoker.

Allergens were selected according to our previous local studies.[12,13] Skin prick tests (SPTs) were performed with commercially available allergens (Greer, Lenoir, NC, USA) including: 1) pollens including tree mix (beech, birch, cotton wood, elm, maple, oak, red river, shagbark hickory, sweat gum, sycamore, white ash), common weed mix (cocklebur, plantain, lamb's quarter, redroot, pigweed, Russian thistle), grass mix (Bermuda, kentucky, meadow, orchard, redtop, ryegrass, sweet vernal, timothy), acacia, birch, palm, Russian thistle; 2) mites including Dermatophagoides farina and Dermatophagoides pteronyssinus; 3) molds (alternaria, aspergillus niger, cladosporium, penicillium, bipolaris sorokiniana); 4) animals including cattle, dog, goat, horse, and feather mix (chicken feathers, duck feathers, goose feathers).

Allergens were pricked with a sterile lancet on patients' forearm. In order to avoid false-positive results, the drops were placed at least 2 cm apart from each other. Histamine (10 mg/mL) and saline were used as positive and negative controls, respectively. The results of the skin tests were examined after 15 min and considered positive when the wheal was 3 mm greater in diameter than the negative control.[14]

Pulmonary function was measured by spirometer (Cosmed, Rome, Italy). All pulmonary function tests (PFTs) were done by one physician in the morning (8-11:00 am) to minimize diurnal variation. Results were expressed as a percentage of normal values. Forced vital capacity (FVC), forced expiratory volume in 1sec (FEV_1), forced expiratory volume in 1 sec to forced vital capacity (FEV_1/FVC), peak expiratory flow (PEF), and forced mid-expiratory flow between 25% and 75% of the exhaled vital capacity ($FEF_{25–75\%}$) were measured. The threshold of abnormality was identified as below 80% of the predicted value for FVC, FEV_1, FEV_1/FVC, and PEF. $FEF_{25–75\%}$ values≤60% of the predicted value were considered abnormal.[15]

Continuous variables were presented as the mean and standard deviation (Mean± SD). The association between two category variables was made using chi-

square test and odds ratio (OR). Cochran-Mantel-Haenszel test was used to evaluate related to two category variable with adjusting age variable (<50 and ≥50). Data analyses were performed with SPSS version16 (SPSS Inc., Chicago, IL, USA). For all data, $p<0.05$ was considered statistically significant at 95% confidence interval (CI95%).

RESULTS

A total of 103 male farmers, aged 19 to 75 years (mean age 47±13 years) and 100 healthy male individuals, aged 15 to 80 years (mean age 41±13.5 years) were included in the study. Farmers were working 2 to 14 hours daily (mean 7.4±3.6 hours), 1 to 7 days weekly (mean 6 days) for a period of 2 to 65 years (mean 25.5±16.37years).

The rate of sensitization to at least one of the applied aeroallergens was 47.6% in farmers compared to 65% in the control group (OR=0.48; CI95%: 0.27 to 0.85) according to SPT. The result of positive SPT to each applied allergens in the farmers and control group is shown in Figure 1. Farmers were significantly less sensitized to pollens than controls (37.9% vs. 56%, $p=0.01$; OR=0.47; CI 95%: 0.27 to 0.83). The frequency of sensitization to mites was 23.3% vs. 28% ($p=0.4$), to animal allergens 11.6% vs. 15% ($p=0.1$) and to molds 7.8% vs. 12% ($p=0.1$) in farmers compared to healthy controls which were not significant.

Based on the questionnaire, 56 (54.3%) farmers reported work-related allergy symptoms. The most frequent symptoms were respiratory symptoms in 32 farmers (31%), followed by skin manifestations in 30 (29%) and allergic rhinitis in 26 (25%).

The results of lung function tests in farmers and controls are shown in Table 1. Mean FEV_1/FVC was significantly lower in farmers than controls, as 17 (16.5%) farmers showed FEV_1/FVC <80% ($p<0.001$).

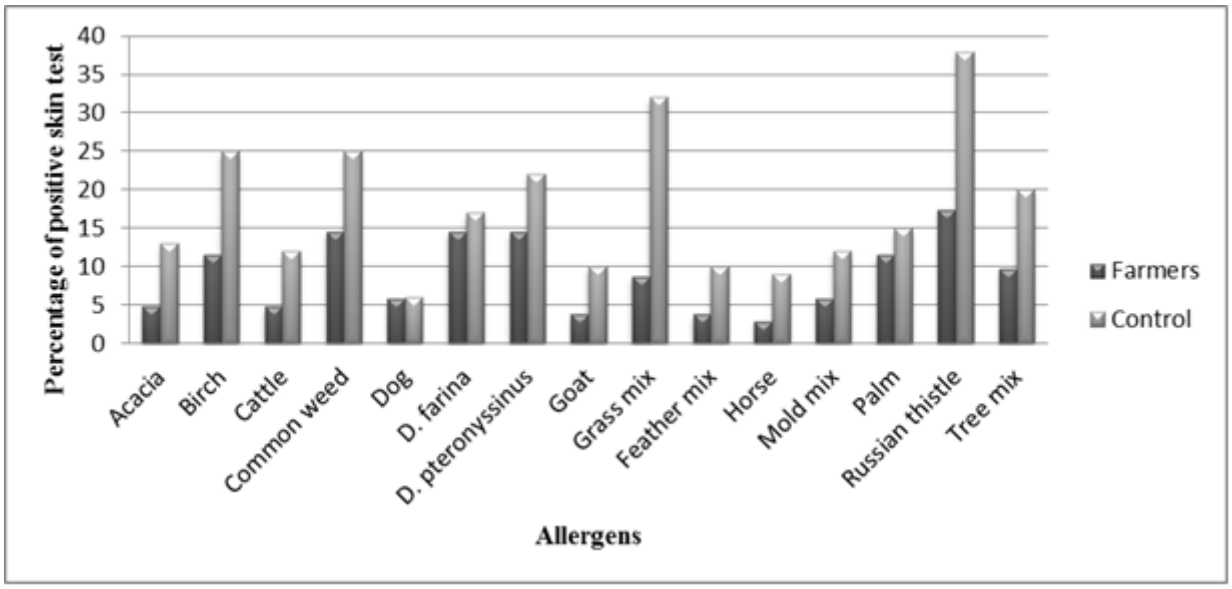

Figure 1. Sensitization of farmers from southwestern Iran compared to healthy controls by the skin prick test

Table 1. Lung function parameters (mean±SD) in farmers from southwestern Iran and healthy controls

Spirometry indices	Farmers n=103 (mean ± SD)	Control n=100 (mean ± SD)	*p* value
FVC %	99.52±20.13	98.36±11.78	0.6
FEV1 %	101.6±21.07	100.44±14.50	0.6
FEV1/FVC %	91.66±12.16	101.49±7.43	<0.001
PEF %	94.90±22.46	97.91±15.56	0.3
FEF 25-75%	95.98±27.71	100.93±30.75	0.2

No association was observed among work-related symptoms, abnormal spirometry indices and positive SPT to at least one of the tested allergens in farmers. Occupational allergy symptoms were higher in those farmers with sensitization to pollens (p=0.04; OR=2.2; CI 95%: 1.10 to 5.18).

There was a correlation between the working days in week with positive SPT (p=0.004) and duration of work experience with abnormal spirometry indices (p=0.03).

The number of smokers among farmers was about two folds more than healthy controls (23% vs. 12%) and there was a positive correlation between smoking and work-related symptoms (p=0.01; OR=2.9; CI 95%: 1.06 to 8.3).

DISCUSSION

Farmers are usually more exposed to allergens during the sowing of seeds, planting crops and harvestings, which may lead to sensitization, work-related symptoms and abnormal lung function brought by different allergic diseases. The most striking finding in the present study was sensitization rate of farmers to the studied aeroallergen which was 50% less than the non-farmer controls. Several factors have been hypothesized to explain the protective effect of farm life against allergic sensitization including contact with animals, exposure to various microbes and endotoxins.[16-18] Consistent with our results, the rate of sensitization in full-time pig farmers was reported 17% in the Netherlands, which is however less than our results (47%). It may be explained by the limited panel of allergens used in their study.[19] In contrast to our findings, a report from Greece showed two folds greater risk of positive SPT among grape farmers compared to control group.[20]

Pollens are considered as one of the main culprits in causing asthma, allergic rhinitis, and probably dermatitis.[21] Our results also showed a high frequency of allergy symptoms in farmers with sensitization to pollens; however, this rate was a half of sensitization of the non-farmer controls who were living near the farms. The second common allergen leading to farmers' sensitization in our study was house dust mite. Predominance of mite's sensitization even more than pollens and animals' dander was also reported in Swedish, British and Danish farmers.[22-24] Unlike to these studies, we did not include storage mites in our study because mites need humidity for growing and our studied region has a dry climate. This can be considered as a reason for this inconsistency.

The frequency of positive skin reaction to 5 mold allergens was 7.8% among farmers in our study while a report from Poland revealed positive SPT to 12 mold extracts in 10.8% of farmers.[3] This higher number may be related to a broader panel of allergens that they used. There is a lot of clinical evidence showing higher prevalence of respiratory diseases in mold-sensitive patients,[3,25] but we did not find such a relation among the studied farmers.

Farmers have a close exposure to animal allergens and their related bacteria due to animal housing, which may give rise to a high Th1-mediated immune responses,[26] and can be considered as one of the most protective factors in decreased sensitization in farmers.

Respiratory symptoms were prevalent in half of the studied farmers in the current study. Increased respiratory symptoms have also previously been reported among French and Swedish farmers.[27-29] In our study, 25% of the farmers were smoker and there was a significant correlation between smoking and their work-related symptoms. Such a link between smoking and respiratory symptoms among Palestinian farmers has been reported before.[10] Exposure to organic dust and using pesticide are also recognized as risk factors for chronic bronchitis in farmers.[30] We found $FEV_1/FVC<80\%$ in 16.5% of the farmers. Abnormal lung function tests have also been reported in French dairy farmers.[25,28,31]

There is a correlation between average duration of farming with abnormal spirometry parameters, which can be explained by more exposure to dust, bacteria, molds and endotoxins that leads to respiratory diseases and decreased lung volumes.

Although positive SPT to common allergens is found to be a risk factor for allergic diseases,[29] no association was observed among reactive skin tests and work-related symptoms in this study. This is in line with non-atopic mechanisms in development of allergic symptoms. Droste et al. also reported that atopy can be considered as an independent risk factor for work-related symptoms.[32]

Our results also showed a relation between reactive skin tests in farmers and the numbers of farming days in week which can be described by increased exposure to different allergens in agricultural regions.

The major limitation of this study was small size of

studied region restricted to the certain farms in southwestern Iran. Extended similar studies in different farms around the country using a broader panel of allergens including storage mites would be done to find the most common causal allergen(s) in the induction of work-related allergy symptoms among the famers in our country.

Our results showed a lower risk of sensitization to aeroallergens among farmers compared to healthy controls. In contrast to the most similar studies, sensitization to pollens was more prevalent than mites among the studied famers. Our data also indicated that smoking was a deciding factor in farmers suffering from occupational allergy symptoms. Efforts to improve working conditions on farms and training programs for farmers about risk factors for allergic diseases can be helpful to reduce the symptoms of work-related allergic diseases.

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