

A comparative study on dust exposure, respiratory symptoms and lung function among farmers and non-farmers

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ABSTRACT

Considering the importance and essence of farmers' health, this study has been conducted with the aim of evaluating the amount of the dust confronting farmers and the farmers' respiratory symptoms and function during the course of wheat collection in 2014 in Zabol villages (Sistan & Baluchestan province, Iran.)

For this cross sectional study, the dust of the respiratory scope of two groups (farmers and non-farmers) was sampled by PVC filter for 90 minutes with the flow rate of 1.5 lit/min on the basis of NIOSH 0500 method during daily 8 work hours of 5 successive days of manual wheat reaping. Data regarding respiratory symptoms (n=50 rural men over the age of 40) was gathered through interviews and questionnaires, and pulmonary function was measured by Spiro lobe (made in MIR of the US); besides, data analysis was done by SPSS 18, T-Test, Chi-Square, and Logistic regression.

The mean dust intensity confronting the farmers was 36.7 mg/m³, and the rate of some breathing complaints namely coughing (P≤0.001), sputum (P≤0.009) and shortness of breath (P≤0.026) became meaningful in the two groups. The average amounts of spirometer parameters of the farmers were less than that of the non-farmers, and the statistical difference of all the parameters except for FEV1/FVC (P=0.06) was meaningful (P≤0.05). The results of the present study indicated that confronting with dust could cause respiratory complaints and decrease spirometer parameters in the farmers.

Key words: Farmer, Dust, Respiratory capacity, Spirometer

INTRODUCTION

Almost 28 percentage points of world's lands are eroded by winds [1]; dust roused by 120-day-long windstorms of Sistan plain, Zabol city and its countryside has had extremely bad impacts in recent decades. Agriculture is an economic activity, and sand storms/ dust storms have harmful effects on the agricultural products and farmers' health. Also, agriculture is apparently considered as a simple and safe vocation, but some factors like industrialization of tools, variety of workforce, unfocused working shifts, few instructive facilities, scattered farming places/ lands, etc. place this vocation as one of the prior ones to be investigated in the field of occupational health [2].

The huge population of this vocation is exposed to serious dangers like physical dangers (sun rays, climate conditions, noise, etc.), chemical dangers (poisons, insecticides, and dust particles), biological dangers, ergonomic dangers (manual work, lifting loads, etc.), and mental dangers (famine threat, flood threat, nomadic lifestyle, etc.) [3].

A farmer in different stages of farming such as soil mixing, cultivation, plowing, harvesting, etc. is exposed to the dust of variant minerals like silicate, calcite, clay with silica source and organic dust like

straw, grains and so on [4,5] causing common respiratory diseases including agriculture asthma, farmer's lung disease, chronic and acute bronchitis, organic dust toxic syndrome (ODTS) [6,7], progressive weak lung function [8], respiratory symptoms (coughing, shortness of breath, and so on and so forth [9].

However, it has been proven in a study in Palestine that there is no significant correlation between breathing disorders and the dust confronting farmers [10]. Unfortunately, many a farmer often considers these breathing symptoms as a part of their vocation and does not visit a doctor unless they are at death's door. The findings of a study in the stormy dry region of Western Canada show that local and regional factors correlate with hidden perilous potentiality of mineral dust in causing pulmonary diseases [11].

Therefore, blowing of the 120-day-long windstorms in the dry region of Sistan, spreading harmful elements like silica in the respiration scope of the residents, is a parameter that threatens the residents' health along with the dust rising from agriculture activities. Aging of the farmers, all the members of a rural family doing farming, and their ignorance over their vocation's dangers make the situation even more difficult [2,12,13].

Considering the limited number of studies regarding the evaluation of dust confronting

farmers, and due to the prevalence of breathing disorders among Sistan's farmers, this case-control study was conducted aiming at reviewing the length of dust exposure, respiratory complaints, and pulmonary function parameters in the farmers of the mentioned area, who are both exposed to agriculture dust and so-called 120 windstorms.

MATERIALS AND METHODS

This cross sectional study was done on 100 rural men over the age of 40 in the two groups of farmers (case group) and non-farmers (control group) in the first half the year in 1392 in Zabul villages. The participants were randomly chosen based on the type of their activities (farmer and non-farmer). In order for controlling the intervening variables in the research's designing stage, two methods of limitation (only males) and random sampling were used. In the data analysis phase, multi-variable logistic regression was used so that the probable role/ trace of the intervening variables were deleted, and matched results were obtained. Afterwards, those male farmers, who planted grains, didn't have respiratory diseases irrelevant to uncontrolled blood pressure, didn't have surgery experiences in their chest and/or stomach, and didn't have cold, influenza, and fever symptoms during testing were selected. The data regarding the farmers' height and weight, measured by stadiometer and calibrated scale were entered into the device along with some demographic data like their birth date, gender and race. Then, required education was given to farmers based on the Pulmonary Capacity Measurement Instruction for the accurate execution of the proper breathing test maneuver by the researcher. It should be noted that, the subject's position during the maneuver execution was a sitting one, his back in contact with the back of the chair. In order to determine spirometer parameters, including FVC, FEV1, FEV1/FVC, and FEF25-75% were measured by Spiro lobe II (Made in MIR of the US); after introducing the accurate maneuver and setting one's sitting position, 3 maneuvers were executed and the best results were reported in the measurement table, and spirometer results were also interpreted by a criterion defined by Lung Physicians Union in 4 patterns of obstructive, restrictive, mixed and normal.

The dust confronting the farmers while manual wheat reaping was sampled by PVC filter (poly vinyl chloride) and sampling system (individual calibrated sampling pump and linking pipes and holder filter) for 90 minutes with the flow rate of 1.5 lit/min on the basis of NIOSH 0500 method. Throughout a whole 8-hour work shift, 5 samples were collected with the above-mentioned characteristics. Samplings were repeated for 5 work

days, and the average amount of confronting dust was measured.

In order for analyzing breathing symptoms, lung questionnaire of medical research council, including questions about demographic data, smoking status, obvious breathing symptoms like coughing, coughing with sputum, feeling pressure on the chest, shortness of breath, dealing with farm animals and pets, and using Nas/ Nsvr (a herbal substance addictive is made from tobacco leaves and lime that is placed in front of the mouth between upper lip and front teeth; toxic substances of this combination are absorbed through mouth and cause addiction for the person.), was utilized after some revisions appropriate for the studied participants [14].

The questionnaires were filled through interviews with both of the groups. For data analysis, SPSS 18, t-Test, Chi-Square, and Logistic regression were used; the meaningful level was lower than 0.05 in all the analyses.

RESULTS

In this study, the average amount of confronting dust was 36.7 mg/m³ for the farmers' group, while it was 0.54 mg/m³ for the non-farmers' group. Average age of the investigated farmers was 64.88 ± 11.32 years, their average weight was 61.36 ± 10.05 Kg, their average height was 165.92 ± 6.06 cm, their average systolic blood pressure counted as 126.40 ± 15.35, and their diastolic blood pressure was reported 77.00 ± 15.94 mmHg; we tried to choose the members of the control with similar features.

As table 1 indicates, the frequency of respiratory symptoms of coughing, sputum and shortness of breath in the farmers' group is more than that of the control group, and chi-square test illustrated that the differences of these groups are statistically meaningful (P < 0.05).

Table 1: Comparing the frequency and percentage frequency of respiratory symptoms for farmers and non-farmers in Zabul city in 2014

Symptoms	Farmer (n=50)		Non-farmer (n=50)		P-value
	Number (percentage)		Number (percentage)		
	Yes	No	Yes	No	
Cough	20 (40%)	30 (60%)	5 (10%)	45 (90%)	0.001
Sputum	14 (28%)	36 (72%)	4 (8%)	46 (92%)	0.009
Feeling pressure on the chest	12 (24%)	38 (76%)	7 (14%)	43 (86%)	0.200
Shortness of breath	23 (46%)	27 (54%)	16 (32%)	34 (68%)	0.026

In table 2, average measured spirometer indices are separately observable in two groups of the farmers and non-farmers. Chi-square showed that there was a meaningful difference between average FVC, FEV1, and FEF25-75% parameters of the case and control groups ($P < 0.05$), and the fact that by aging, pulmonary capacity has decreased.

Table 2: Comparing average spirometer parameters in the farmers and non-farmers of Zabul in 2014

Function	Farmer (n=50) Mean (95%CI)	Non-farmer (n=50) Mean (95%CI)	P-value
FVC	2.54 (2.29-2.79)	3.41 (3.17-3.64)	<0.001
% FVC	73.02 (65.74-80.30)	85.47 (79.75-91.19)	0.008
FEV1	1.92 (1.73-2.11)	2.82 (2.62-3.02)	<0.001
% FEV1	69.83 (63.48-76.18)	89.87 (83.67-96.08)	<0.001
FEV1/FVC	77.52 (72.81-82.23)	83.53 (79.26-78.80)	0.06
FEF25-75	2.05 (1.74-2.35)	3.48 (3.11-3.85)	<0.001

Table 3 demonstrates the frequency of spirometer results in 4 patterns (obstructive, restrictive, mixed, and normal) for both of the groups. Based on the findings of the present study, restrictive pattern is the commonest pattern among the farmers with 38%. Healthy members of the farmers' group captivate 28% of the group's population, while frequency percentage of healthy people in the non-farmers' group (control group) was reported 64%.

Table 3: Comparing frequency of the interpretations of spirometer results in the farmers and non-farmers of Zabul in 2014

Group Lung disease	Farmer (n=50) Number (percentage)	Non-Farmer (n=50) Number (percentage)	P-value
Obstructive	11(22%)	3(6%)	0.002
Restrictive	19(38%)	13(26%)	
Combined	6(12%)	2(4%)	
Normal	14(28%)	32(64%)	

Information like the participants' occupation, age, height, weight, smoking status, Nsvar abuse, blood pressure, keeping and dealing with farm animals

and pets was entered to the logistic regression test. As table 1 shows, occupation type and Nsvar abuse are 4 or 5 times more effective .

Table 4: Logistic Regression analysis for the sake of determining the connection of 3 variables of occupation, Nsvar abuse, and breathing disorders.

Logistic Regression	Univariate model	Multivariate model
Occupation (farmers vs. non-farmers)	4.57 (1.96-10.64)	4.08 (1.67-9.96)
Nsvar (abusing it vs. not abusing it)	5.75 (2.09-15.8)	5.08 (1.77-14.6)

DISCUSSION

The results of the present study showed that, the farmers are highly exposed to dust more than the members of the control group.

Respiratory disorders and progressive weak pulmonary function are observed in the case group more than the control group. A study by Molazinc et al. estimated average dust exposure of the farmers over 25% [4], the dust which was demonstrated to have 1 to 17% silica based on a study in Canada [11].

Sistan area has already been introduced as a windy region in a research (about 70 day in year) [15]; however, it is claimed in Khosravi studies that, 173/2 days of a year are windy in Zabul city [16]. The commonest breathing complaints of the farmers were shortness of breath with 46% and coughing with 40%; these results are compatible with the results of other studies [6, 10, 17].

Reviewing spirometer parameters in the two groups proved that, FVC, FEV1, and FEF25-75% of the farmers decreased more than that of the control group, noting that aging and dust exposure factors were seen to be more effective in working environments [3, 18-21]. On the contrast, the relationship between dust exposure and reduced lung parameters has not been confirmed in a study done on the Palestinian farmers [10].

Lung function results of this study indicated that, there is a meaningful difference between the frequencies of restrictive pattern (38%) and other unhealthy patterns (obstructive 22% - mixed 12%) among the farmers and among the members of the control group.

These gained results to cope with the results of other studies [12, 19, 20, 22]. Considering Sistan's residents exposure to 120 windstorms and high percentage of sand and silica in the dust, it seems to be a relationship between existing 38% of restrictive respiratory disease among the farmers and dust inhalation percentage.

Due to economic issues, successive famines in the area, and culture of this part of the country, no personal safety tools are utilized by the residents while exposing dust. In spirometer interpretation, 36% of the control group contracted to restrictive, obstructive, and mixed unhealthy patterns, while 72% of the case group contracted to the mentioned diseases. That is, 72% of the people doing this occupation have the symptoms of restrictive, obstructive or mixed restrictive-obstructive patterns. In other words, 64% of the control group has healthy patterns based on the measured spirometer parameters, but only in 28% of the farmers this healthy pattern was seen.

In addition, the results of this study showed that, permanent Nas (Nswar) abuse by the farmers is 5 times more hazardous and tremendously influential on the respiratory parameters; it is worth noting that 31% of the studied participants were addicted to this substance. Prevailing Nswar abuse among the farmers and its high risk rate in declining respiratory parameters urgently asks for evaluating toxicological effects of this substance and warning farmers of using it.

CONCLUSIONS

The results of the present study demonstrate that, wheat farmers are exposed to high intensity of dust, and slow pulmonary function and respiratory disorders are more common among the farmers than the members of the control group. Such problems are more acute for the Sistan's farmers due to the 120 windstorms. Thus, holding influential educative courses, evaluating work environments, utilizing advanced tools and personal safety facilities for health maintenance of all the farmers, especially the farmers of this area, is necessary.

ETHICAL ISSUE

In this study, the Islamic Azad University ethics committee approved the study protocol and researches explained all procedures and requirements to participants. They voluntarily signed a consent form before enrolling in the study.

COMPETING INTEREST

Authors of this manuscript declare that we have no significant competing interests that might have influenced the performance of the work described in this manuscript.

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AUTHORS' CONTRIBUTIONS

All authors equally help to write this manuscript.

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