RESEARCH ARTICLE

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Clinical Respiratory Symptoms and Spirometric Parameters among Tile Manufacturing Factory Workers, Yazd, Iran

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Background & Aims of the Study: Respiratory diseases are considered as the most important occupational diseases and the absence in the workplaces. Workers in the tile and ceramic industries are exposed to high concentrations of dusts. The main aim of the present study was to evaluate the pulmonary reactions and pulmonary function tests associated with exposure to dust among workers of a tile industry, Yazd, Iran.

Materials & Methods: This research was designed as a cross-sectional research. All workers (n=26) working in the press and spray halls were considered as exposed (case) group. Also 17 unexposed workers (control group) were selected for interview as well as respiratory symptom questionnaires were administered to them. Demographic data and lung function tests of participants were gathered and analyzed.

Results: Demographic and socioeconomic variables of both groups were similar ($p>0.05$). Total dust and respirable dust were measured in the exposed group equals to 29.94±10.24 and 17.69±7.57. Total dust and respirable dust in the control group were measured equals to 3.94±2.62 and 1.73±4.7 respectively. The results were different significantly ($p<0.05$). The prevalence of respiratory symptoms was 11.5-38.5%. These symptoms in case group compared to control group, had higher prevalence of cough, phlegm. The results were significantly increased in exposed workers than unexposed workers ($p<0.05$). Decrease in pulmonary function test was significantly higher in exposed workers than unexposed workers ($p<0.05$).

Conclusion: Our finding revealed that a clear link exists between high levels of airborne dust and the prevalence of respiratory symptoms among workers. Based on this fact and in order to reduce pulmonary complications, preventive measures plan in the factory, such as technical measures (suitable ventilation system) and training programs about the proper using of personal protective equipment should be considered.

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Background

Respiratory diseases are one of the most common occupational diseases as well as the main cause of the work absence (1). Occupational dust exposure can cause lung diseases such as bronchitis and asthma (2,3). Long term exposure with respirable dust in the workplaces is a main risk factor for chronic lung diseases and many respiratory disorders (4). Studies had shown that the respiratory disorders incidence caused by occupational exposure were between 4.5 and 19% (5,6). Among the tile industries worldwide, tiles industry is among the industries where workers

are often exposed to hazardous dust material (7-10). Some pulmonary fibrotic diseases can produce by dust exposure (11). Silica is considered as a noticeable respirable particles in the environment. Silicosis, lung cancer and chronic obstructive pulmonary disease are considered as the outcome of long-term exposure to crystalline silica (12,13). Previous studies had shown that a statistical relationship existed between silica exposure and increasing risk of pneumoconiosis, bronchitis and respiratory distress (14,15). Another study was done in 2007 in several tile and ceramics factory increasing risk of chronic obstructive pulmonary disease was reported (16). In a similar research in the tile industry, problems such as high incidence of respiratory problems, including coughing, wheezing, shortness of breath and phlegm among workers as well as decreasing in pulmonary function indices were observed (17).

Dehghan et al. in a study in Yazd province a significant increase had been reported in respiratory problems among workers. Also a significant reduction in spirometric parameters was observed (18). However, in a study in Italy a noticeable reduction in spirometric parameters had been shown (19). Halvani et al. in a study in Yazd were reported a significant relationship between the respiratory symptoms and dust exposure. But were not observed significant association between the dust amount and reduced lung function parameters (11).

Aims of the study:

The main purpose of the present study was to evaluate the pulmonary reactions and pulmonary function tests associated with exposure to dust among workers of a tile industry located in Yazd, Iran. Our finding results can be applied in implementing preventive measures. Also, it can be beneficial for employers and other stockholders for control of airborne dusts. The dust reduction and management of pollutants in the workplaces is an important challenge, therefore, it seems that the research finding can be applied for air pollution control strategies.

Materials & Methods

All workers (n=26) while working in the press and spray halls were selected as exposed group. Also, 17 people without any exposure to dust (but working in the tile manufacturing factory) were included by random sampling (control group). The control group was selected based on matching of the socio-economic variables (gender, education level, smoking behavior and economic level). The present study was designed based on the Helsinki declaration (20) and all participants were signed a consent form. History of respiratory disorders, chest surgery and lung injuries were selected as exclusion criteria. The healthy persons had no history of previous and current dust exposure. Gathering data was done through interview and questionnaires. This valid questionnaire was applied based on the American Thoracic Society (ATS) (17,21). In this questionnaire, the questions about individual respiratory conditions, chronic cough, wheezing, shortness of breath, sputum, bronchitis, smoking behavior, workers and their family's medical records, job type, work history and previous jobs especially jobs with risk of respiratory distress has been used for collecting data.

Dust exposure monitoring of the studied workers was done by respirable dust particle sampling (less than 5 microns in diameter) and non-respirable dust particle sampling (equal to or greater than 5 microns in diameter). Selected method for analysis was weighting. Based on the sampling protocol the 37mm/0.5µ PVC filters, accompanied with a cyclone were used. According the similar studies (NIOSH method No. 7601) a flow rate equals to 2 liters per minute were adjusted and total volume of sampling equals to 400-800 liters were taken. For respirable dust and total dust a Threshold Limit Value (TLV) equals to 3 and 10 milligrams per cubic meter were considered respectively (22).

In order to pulmonary function assessment Forced Vital Capacity (FVC), Forced Expiratory Volume in the first second (FEV1), FEV1/FVC, forced Expiratory Flow at 25-75% (FEF25/75) and Peak Expiratory Flow (PEF) were applied accompanied with a calibrated spirometer. The gathered data was analyzed aided by SPSS V.21. In all tests, the significance level of 0.05 was assumed.

Results

As was shown in Table 1 among personal characteristics and history of smoking were not observed statistically significant differences between two groups (cases and control).

Duration of exposure to dust among cases was reported as 6.11±3.81 years. Also respirable and non-respirable sampling result was measured among the exposed group equals to 29.94±10.24 and 17.69±7.57 mg per cubic meter of air, respectively. Detailed information was included in Table 2.

Table 1) Demographic characteristic of the exposed person (M±SD)

Variable	Cases (n=26)	Control (n=17)	P_{Value}
Age (years)	31.61±4.41	33.23±4.96	0.27
Weight (kg)	73.11±7.47	73.11±9.4	0.98
Height (cm)	172.92±3.86	171.41±2.21	0.16
Work history (Years)	6.11±3.81	5.88±4.82	0.86
Smoking duration (Years)	0.84±2.2	1.58±3.6	0.41
Smoking Frequency	1.84±0.36	1.82±0.39	0.84

Table 2) Dust sampling results (milligrams per cubic meter) (M±SD)

Variable	Cases (n=26)	Control (n=17)	P_{Value}
Total dust	29.94±10.24	2.62±3.94	0.001
Respirable dust	17.69±7.57	1.73±4.7	0.001

Based on Table 3 the prevalence of respiratory symptoms such as continuous cough, phlegm, wheezing and shortness of breath (11.5-38.5) among exposed workers were reported. Based on before mentioned symptoms a statistical difference was observed between case and control groups.

Compared spirometry results were revealed that significant difference was existed between two studied groups of parameters such as FEV1/FVC, FVC, and FEV1 (Table 4).

As was indicated in Table 4 a significant association was reported between dust exposure and respiratory tests (FEV1/FVC, FVC, FEV1 and PEF).

Table 3) Frequency (%) of the abnormal clinical finding among case and control group

Variable	Cases (n=26)	Control (n=17)	P_{Value}	Chi-square
cough	38.5	5.9	0.029	5.73
phlegm	38.5	5.9	0.029	5.73
wheezing	19.2	5.9	0.37	1.52
shortness of breath	11.5	0	0.26	2.1

Table 4) Spirometry results between the two groups (M±SD)

Variable	Cases (n=26)	Control (n=17)	P_{Value}
FVC	91.2±10.3	103.58±7.37	0.001
FEV_1	90.96±10.2	101.47±6.1	0.001
PEF	84.65±13.66	97.26±11.22	0.003
FEV_1/FVC	89.32±10.31	98.94±6.94	0.002
FEF25/75	83.61±18.1	91.29±13.27	0.14

Discussion

Based on our results a clear linkage was existed between dust concentration and the pulmonary symptoms in the tile industry. Also obvious changes were observed in some parametric indices among cases and control groups. Our finding was in line with Sakar et al. study (23). In the present study the prevalence of pulmonary symptoms of cases group was reported up to 38%. In some previous studies, this prevalence rate had been reported equal to 44%. This difference is probably due to more history of the exposed workers (24). In accordance with the Neghab et al. research a significant difference about respiratory symptoms was observed between the two studied groups (17). In the Bahrami et al. study, more respiratory symptoms (not statistically significant) than our control group results were observed (1). In another study that was conducted by Masngut et al. in the ceramic factory the prevalence of respiratory symptoms was decreased significantly between two groups: those exposed to dust when using protective apparatus and people without them (25). Based on our finding, for the exposed group wheezing and shortness of breath difference was not significant. However, this finding was greater among exposed cases. Perhaps the similarity of the results is interpreted to the required time for the symptoms emergence.

Pulmonary function test differences between two studied groups in line with other literature were significant statistically (17,26). The difference between spirometric indices can be related to the airborne dust concentration. This result was similar to several studies (17,18,13,24). Mehrparvar et al. were studied pulmonary function test changes among exposed workers overtime periods. Their study had been concluded that over two year intervals, pulmonary function tests had been decreased significantly (26). Another reason for different results between cases and control groups may be related to dust concentration existing in the workplace. This result is similar with some studies (19,27) but Sakar et al. study was not reported a significant reduction in the FVC and FEV1 indices between cases and control groups (23).

Our finding also revealed that a clear link exists between the prevalence of respiratory symptoms and levels of airborne dust among workers. In another study, a significant decrease in was observed FVC and FEV1 (17). Other authors in their studies showed spirometeric measures decreased significantly for exposed workers to the airborne dust and fumes (28-31).

Conclusion

In the present study a significant relationship was reported between exposure to airborne dust concentration and some pulmonary symptoms (cough and sputum). Also a decrease was observed in parametric indicators of pulmonary function (FEV1/FVC, FVC and FEV1 or PEF). For reducing the pulmonary complications, preventive measures plan in the factory, such as technical measures (suitable ventilation system) and training programs should be considered.

Footnotes

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Conflict of Interest:

The authors declared no conflict of interest.

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