ORIGINAL RESEARCH ARTICLE

Tanaffos (2003) 2(6), 25-30

Pulmonary Complications in Workers of Bafnaz Textile Factory in Isfahan

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ABSTRACT

***Background**: The present study was conducted to examine adverse pulmonary effects of exposure to cotton dust in Isfahan*

***Materials and Methods**: All employed workers of Bafnaz textile factory were studied by medical interview, physical examinations, and spirometry in symptomatic subjects. Frequency tables were used to extract major symptoms and pulmonary illnesses. Logistic regression analysis was used to evaluate relationships between illnesses and possible risk factors.*

***Results**: All workers had some potential exposure to cotton dust; mean employment duration was 18.20±5.34 years. Prevalence of chronic cough, chronic bronchitis, asthma, and byssinosis was 2.4%, 30.8%, 9.2%, and 3.9% respectively. Odds ratios (OD)and 95% confidence interval (CI)for prevalence of chronic bronchitis and byssinosis in those working in most dusty jobs, after adjustment for age, smoking habit and duration of employment were; 1.77 (1.10-3.04), and 1.41 (1.33-2.63) respectively. In these textile workers, chronic respiratory symptoms and disorders were associated with job category after correction for age and smoking habits.*

Conclusion**: These data support the evidence for an increased prevalence of respiratory disease in populations exposed to cotton dust.* ***(Tanaffos 2003; 2(6): 25-30).

***Key words**: Cotton dust, Pulmonary function, Respiratory symptoms; Byssinosis*

INTRODUCTION

Occupationally related exposure to cotton dust has been implicated in exacerbation of airway diseases including byssinosis (1-2) chronic bronchitis (3-4) and pulmonary function impairments (5-6). Most of the previous studies have focused on the typical syndrome of byssinosis, which is described as a feeling of chest tightness and shortness of breath that occurs on the first day of the working week, progressing to include other days in advanced stages. It has been known that attacks of typical byssinosis usually begin to appear after several years of exposure (1) and earlier pulmonary responses to cotton dust may be characterized by reversible respiratory symptoms and acute decrements in lung function (7-8).

Industrial pollution is probably more hazardous in developing countries than that of the developed world (9).

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The purpose of the current study is to determine the prevalence of byssinosis, asthma, chronic bronchitis, and respiratory symptoms among cotton dust workers in Bafnaz textile industry in Isfahan.

MATERIALS AND METHODS

Study subjects:

The study was approved by the Institutional Review Boards of the Isfahan Medical School.

The original cohort included all workers at Bafnaz textile industry gradually surrounded by Isfahan living areas. A total of 884 workers who were assigned to various jobs in the factory at the time of the study participated in the survey conducted from March 2000 to January 2001. Their socioeconomic status, geographical area, education level, and occupation were relatively homogeneous.

Questionnaires:

A modified American Thoracic Society (ATS/DLD) questionnaire (10) was used. The questionnaire was translated into Persian and then translated into English to verify accuracy. Questionnaires collecting information on complete work history, respiratory symptoms, and smoking history were administered by interns of Isfahan Medical School. The symptoms of interest in the analysis included chronic non-specific cough, asthma, byssinosis, and chronic bronchitis.

Chronic non-specific cough is defined here as a usual cough not meeting criteria for chronic bronchitis.

Asthma is defined as dyspneal attacks associated with wheezy breathing.

Byssinosis is defined as chest tightness and breathlessness occurring in the first working days with a weekly repeating character, gradually progressing to be felt in most days in advanced stages.

Chronic bronchitis is chronic productive cough for at least 3 consecutive months, presented at least for 2 consecutive years.

Lung function testing:

Spirometric measurements were conducted by a trained technician using an electronic spirometer (Erich Jaegers Wurzburg, Germany) calibrated daily with a 3-liter syringe. Each worker performed up to eight trials to produce three acceptable curves. The analysis of the study focused on indices of expiratory volume in one second (FEV1), forced vital capacity, (FVC), and forced expiratory flow rate at 25 to 75 percent of vital capacity (FEF25-75). Acceptable FEV1 tracings were allowed to vary by no more than 5%, and the best FEV1 and FVC were used regardless of whether they were on the same tracing. All values were corrected to conditions of body temperature and pressure saturated with water vapor (BTPS). The same technicians, instruments, and standardized methodology were used throughout the study.

Statistical analysis:

The lung function data were expressed as percent of prediction. The reference values were obtained from Knudson and coworkers (11).

Clinical and spirometric data were collected in a data base and analyzed using Statistical Package for the Social Sciences (SPSS) Ver.10. Frequency tables were used to determine the prevalence of symptoms or abnormal findings. Multiple regression analysis was used for determination of the correlation between findings and the recorded risk factors including age, smoking habits, duration of works, and working in the most dusty environments.

RESULTS

All of the 884 workers were male aging between 24 and 63 years (Mean SD = 36.73± 6.20), mostly with low levels of education. The duration of working in this population was between 2 to 40 years (Mean SD = 18.20±5.34)

Table 1 Shows the Anthropometric characteristics of the studied population.

Table 2 Shows frequency of pulmonary symptoms in the cohort.

Table 3 shows mean and SD of spirometric findings in the studied population. Frequencies of abnormal spirometric findings are also reported in table 3.

Table 4 presents the association of described illnesses with available risk factors.

Table 1. Characteristics of the workers enrolled in the study

Variable	Number	Percent of 561
Age:		
< 35 years	404	45.7
35 years and more	480	54.3
Smoking:		
Current Smokers	371	42.0
Ex-smoker home-mate with usual indoor smoking habit	63	7.1
Never smoker	450	50.9
Education:		
Illiterate	52	5.9
Primary school or less	459	51.9
Junior high school	276	31.2
High school	87	9.8
Missing	10	1.2
Jobs:		
Carding	225	25.5
Yarning	404	45.7
Weaving	190	22.3
Finishing	32	3.6
Missing	33	3.7

Table 2. Major clinical findings in the population and relationship to smoking habit by student test

Illness condition	Smokers & Ex-smokers (434 subjects)	Non-smokers (450 subjects)	Total (884 subjects)	p-value
Chronic non specific cough	8 (1.8%)	12 (2.9%)	20(2.4%)	0.31 NS *
Chronic Bronchitis	148 (34.1%)	112(27.3)	260(30.8%)	0.19 NS
Asthma	40(9.2%)	38(9.2%)	78(9.2%)	0.54 NS
Byssinosis	12(2.9%)	19(4.8%)	31(3.9%)	0.11 NS
History of Tuberculosis	2(0.2%)	0 (0%)	2(0.2%)	0.26 NS
Wheeze heard over the chest	9 (2.07%)	8 (1.77%)	17 (1.9%)	0.09 NS
Rhonchi heard over the chest	17 (3.9%)	28 (6.2%)	45 (5.09%)	0.04
Crackles heard over the chest	2 (0.46%)	1 (0.22%)	3 (0.34%)	0.22 NS

* NS = Not Significant

Table 3. Spirometric findings in the examined population.

Spirometric parameter	Mean measured value	Mean predicted value	Percent measured/predicted	Number of subjects with abnormal PFT
FVC	4.39±0.80	4.45±0.44	98.6±14.4	9
FEV1	3.60±066	3.72±0.36	96.87±15.22	12
PEF	8.43±2.12	8.94±0.58	94.39±23.23	36
FEF25-75	3.63±1.12	4.40±0.32	82.55±25.04	37

PFT = Pulmonary Function Test

FVC= Forced Vital Capacity

FEV1=Forced Expiratory Volume in 1st Second

PEF= Peak Expiratory Flow Rate

FEF25-75=Forced Expiratory Flow-Rate at 25 to 75 percent of FVC

Table 4. Association of respiratory conditions with various risk factors as disclosed by logistic regression analysis

Respiratory conditions and associated risk factors	Results of logistic regression analysis	
	p value	OR(CI)*
Current asthma		
Age	0.47	1.16(0.77-1.74)
Smoking habits	0.78	0.94(0.63-1.41)
Duration of employment > 10 years	0.11	2.27(0.82-6.33)
Work in dusty jobs	0.03	1.77(1.10-3.04)
Chronic Bronchitis		
Age	0.003	1.59(1.17-2.15)
Smoking habits	0.03	1.39(1.04-1.88)
Duration of employment > 10 years	0.05	1.11(1.02-1.73)
Work in dusty jobs	0.025	1.77(1.10-3.04)
Byssinosis		
Age	0.28	0.65(0.3-1.42)
Smoking habits	0.17	0.59(0.29-1.25)
Duration of employment > 10 years	0.049	1.02(1.01-1.28)
Work in dusty jobs	0.041	1.41(1.33-2.63)

* R(CI)= Odds Ratio (Confidence Interval)

DISCUSSION

This study observed the pulmonary responses to cotton dust among chronically exposed workers. The cohort was made up of same gender, with no pre-existing cardio-respiratory diseases and/or chest symptoms; however, this expression should be cautiously believed since it is a usual mood in workers to exaggerate the symptoms and to deny self-administered risks such as cigarette smoking. Therefore, our results need to be interpreted in light of such limitations. There was a great attrition of the original cohort, especially during the study period, largely because of some reorganization in the factory, leading to a number of workers leaving from the industry, a process which finally terminated in total closure of it. It may suggest that the dropouts were likely to be more predisposed to the effects of cotton dust. Hence, this study could be subject to a "healthy worker effect", leading the health outcomes related to cotton dust exposure being underestimated. In spite of that, the findings of this study are informative and helpful in further understanding of the natural history of pulmonary responses to the exposure of cotton dust.

We showed a remarkable number of workers to have serious chest complaints, and many of them suffered serious respiratory illnesses including asthma, byssinosis and chronic bronchitis which is twice that of Isfahan adult population (12-13). Such a high prevalence of respiratory diseases in workers can be attributed to old textile machinery and old environmental safety measures which could not prevent heavy dust exposure in the working places.

As noted in table 4, smoking was greatly more prevalent in this cohort than similar male populations in Isfahan (12,14), and smoking may partly explain

the increased prevalence of chronic bronchitis but not asthma and byssinosis.

Non-specific respiratory symptoms appeared to be the earliest pulmonary response to cotton dust.

The symptoms occur as a rapid response to the onset of exposure, and then tolerance develops with continued exposure, as observed in the early stage of byssinosis and inorganic dust toxic syndrome. In some recently published longitudinal studies, it has been noticed that the early occurring symptoms may be an important risk factor for subsequent decrement of lung function (1-2).

In summary, our findings show that exposure to cotton dust was associated with chronic respiratory symptoms and illnesses and also changes in lung function. The illnesses increase in number and severity with advancing age and duration of exposure to cotton dust. Cigarette smoking obviously increases the risk of developing chronic bronchitis.

ACKNOWLEDGEMENTS

1. The authors thank Dr Pari Zangueneh and Dr Rashidian for their assistance in fieldwork.
2. This study has been supported by grant NO 78118, Research Department of Isfahan University of Medical Sciences.

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