

# Respiratory disorders among tobacco workers

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Respiratory disorders among tobacco workers, in particular dyspnoea, emphysema, and chronic bronchitis have been reported<sup>1</sup> and recent investigations postulate a possible asthmatic effect of tobacco dust<sup>2</sup> (and V Cvetanov *et al*, at 5th Yugoslavian-Swedish Symposium on Occupational Health, Stockholm 1979).

As an organic material, tobacco may be contaminated with microfungi, which are well known to cause allergic asthma and extrinsic alveolitis.<sup>3,4</sup> The aim of the present study was to determine whether tobacco workers differ from controls in their respiratory symptoms and lung function.

## Subjects and methods

The tobacco plant, mainly producing cigars, is in Funen, Denmark. It has 16 employees all of whom took part in the investigation. Clerical staff from two neighbouring public offices employing 225 workers were selected as possible referents. Thirty two were selected at random using the following criteria: same sex, age  $\pm$  5 years, and same consumption of tobacco as the subjects.

The occurrence of pulmonary symptoms, including symptoms of chronic bronchitis, were assessed with a structured interview according to the standard British Medical Research Council Questionnaire.<sup>5</sup> Immediately after the interview individual ventilatory capacity (FVC and FEV<sub>1</sub>) was measured using a Vitalograph. Predicted normal values of FVC and FEV<sub>1</sub> were calculated using the formulas of Cotes.<sup>6</sup> Using a Wright peak flow meter, the subjects were also asked to record their peak expiratory flow rates (PEFR) four times a day (on awakening, at noon, at supper, and before going to bed) for a period of at least seven days. Each time, three forced expirations were performed and the highest value was used for analysis. The diurnal percentage change in PEFR was estimated from the following formula<sup>7</sup>

$$\frac{\text{Highest value} - \text{lowest value}}{\text{highest value}} \times 100 \text{ per cent}$$

For each subject the greatest diurnal percentage change was obtained and the mean percentage change over seven days was calculated for both groups.

## Environmental assessment

Environmental assessment in the tobacco plant was performed concurrently with the medical examinations, including breathing zone evaluation for total dust. Five long term samples were collected. Conventional dust sampling gravimetric methods were followed using 37 mm membrane filters and personal sampling pumps. A flow rate of two litres a minute was used.<sup>8</sup>

Quantification and identification of airborne microfungi were performed by means of a BIAP slit-sampler as described with V-B-agar added antibiotics.<sup>9</sup>

Quantification of airborne bacteria, and among these airborne thermophilic actinomycetes, was performed in the same way using P-C-A and T-S-A-medium.

Determination of organic macromolecular component of the tobacco dust was done according to Gravesen *et al*.<sup>9</sup>

## Analysis

Data are presented as means with standard deviations. The statistical tests used include chi-squared test and Student's *t* test for paired data.

## Results

Exposed and control workers were comparable in age, sex, height, and smoking habits (table 1). The mean number of years of employment for tobacco workers was about 20.

The mean level of tobacco dust was 0.48 mg/m<sup>3</sup> (range 0.27-0.89 mg/m<sup>3</sup>). The amount of spores from different species of micro-organisms was: microfungi 179 col/m<sup>3</sup>, bacteria 4990 col/m<sup>3</sup>, and actinomycetes 29 col/m<sup>3</sup>. The level of macromolecular components was 14.5 mg/g dust.

Among the tobacco workers, 69% reported symptoms compatible with asthma compared with 6% of

Table 1 Characteristics of tobacco workers and controls

	Tobacco workers	Controls
Men (No)	3	6
Women (No)	13	26
Age (year)	42.9 ± 10.2*	43.5 ± 10.2
Height (cm)	166.3 ± 8.8	166.5 ± 6.5
Years worked	19.8 ± 11	—
Per cent smokers	43.8	43.8
Daily cigarette consumption	13.2 ± 4.1	12.1 ± 4.1

\*Mean ± standard deviation (SD).

the controls. Tobacco workers tended to report eye symptoms and symptoms of chronic bronchitis more often, but these differences were not statistically significant. Table 2 shows the mean spirometric values controlled for age and height. The tobacco workers have significantly lower FVC and FEV<sub>1</sub> values than the controls.

The mean diurnal change in PEF<sub>R</sub> during one week was 14.3% for the tobacco workers compared with 9.8% for the controls (table 3). This difference is statistically significant. Eight tobacco workers (50%) had diurnal variation in lung function more than 20% on one or several days. Only four of these smoked tobacco.

## Discussion

Occupational exposure to organic dusts may harm the airways through their allergic components. Atopic subjects are well known to be more likely to develop allergic diseases on exposure to organic allergens than non-atopic subjects. In addition to the allergenic property of the dust, contamination by microfungi and mites is possible under certain conditions.<sup>1</sup>

Previous investigations have found large numbers of microfungi in the tobacco industry and allergic asthma and alveolitis have been described among tobacco workers.<sup>3,4</sup>

In our investigation the amount of tobacco dust was low, 15–20% of the Danish threshold limit value on average. The mean level of microfungi was the same as that of airborne moulds in schools with carpets and verified indoor climate complaints and ten times the bacterial level from the same types of institution. The content of macromolecular organic components (potential immunogenic material) in the tobacco dust

Table 2 Baseline lung function of 16 tobacco workers and 32 controls

	Tobacco workers		Controls		<i>p</i> Values
	$\bar{x}$	SD	$\bar{x}$	SD	
FVC	94.1	± 17.3	109.0	± 16.8	<i>p</i> < 0.01
FEV <sub>1</sub>	99.1	± 23.8	116.8	± 18.5	<i>p</i> < 0.01

Table 3 Mean percentage change in PEF<sub>R</sub> over seven days for 16 tobacco workers and 32 controls

	Tobacco workers		Controls		<i>p</i> Value
	$\bar{x}$	SD	$\bar{x}$	SD	
ΔPEF <sub>R</sub> (%)	14.4	± 7.3*	9.5	± 3.7	<i>p</i> < 0.01

\**p* < 0.01.

was, however, unexpectedly high; six times higher than in house dust from schools and institutions with indoor climate complaints.<sup>9</sup>

The symptom survey showed that the tobacco workers differ significantly in their complaints of asthmatic symptoms from the controls. The measured diurnal variations in lung function were more than 20% for half the tobacco workers. An association between tobacco smoking and this finding cannot be excluded but only four persons with verified bronchial hyperreactivity were smokers. The mean diurnal variation measured during a week is significantly greater in the group of tobacco workers than the controls and supports the assumption that exposure to organic dust might be the reason.

Previous investigations by Valić *et al.*<sup>2</sup> and Cvetanov *et al.* (Stockholm 1979) found a significantly increased prevalence of asthmatic symptoms and a mean acute decrease in ventilatory capacity during the workshift in the exposed group compared with the controls. The degree of bronchial hyperreactivity found by Valić was independent of dust exposure level. Investigation of the possible immunogenic content in the dust was not performed. The failure to show a dose response association may result from a specific airway sensitivity among some of the tobacco workers.

Further, we find that the tobacco workers had a significant decrease in measured lung function capacity. In general, tobacco smoking is the main reason for chronic obstructive bronchitis and the prevalence of the disease differs with sex and age. In our investigation these confounder variables were uniform in both study groups.

The results indicate an association between chronic obstructive lung disorders and long term exposure to tobacco dust ( $\bar{x}$  = 20 years), even without significant differences in the prevalence of simple chronic bronchitis between the study groups.

Other investigations, however, have failed to establish this association. Cvetanov *et al.* finding a significant increase in the prevalence of chronic bronchitis and reduced ventilatory capacity in the exposed group, assumed that smoking and age were the main reasons (Stockholm 1979). A cross sectional study of 318 non-smoking women tobacco workers, mean employment 15 years, and 250 controls showed no

chronic respiratory disorders among the tobacco workers.<sup>2</sup>

The data from this study indicate that long term exposure to tobacco dust and associated dust including potential immunogenic components is harmful to the airways. Even the low levels of tobacco dust, a mean of 0.5 mg/m<sup>3</sup> did not seem to prevent bronchial hyperreactivity among some of the tobacco workers.

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