

CLINICAL SYMPTOMS IN COTTON MILL WORKERS IN SWEDEN

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ABSTRACT

The prevalence of byssinosis and other symptoms and their relationship to the levels of dust and Gram-negative bacteria was studied in five cotton mills in Sweden. A total of 243 workers in bale opening areas, card rooms and spinning areas were included in the survey. The workers were interviewed about chest tightness and other respiratory symptoms occurring on return to work on Mondays, about chronic bronchitis and smoking habits.

The prevalence of grade 1/2 byssinosis varied between different mills with an average of 20%. The presence of byssinosis in workers was related to the length of employment, but cases of byssinosis were also found among persons who had only been working for a few years. No relationship was found between smoking habits and byssinosis.

The presence of byssinosis among workers in cotton mills, particularly in card rooms, has been well documented in numerous studies from many different countries. The prevalence of the disease has been related to the dust level and standards based upon dust measurements are in use.

The results of epidemiological and animal studies suggest that the bacterial contamination of cotton, notably with Gram-negative bacteria, is important for the development of byssinosis^{2,6}. Certain results indicate that the factors such as smoking or length of employment should also be considered^{3,5}.

The study presented here was undertaken to examine the prevalence of byssinosis among cotton mill workers in Sweden. The objectives of the study were to evaluate the importance of individual factors for the development of the disease and to relate the presence of the disease to the amount of dust in the mills and to the number of airborne Gram-negative bacteria.

SUBJECTS AND METHODS

The investigation was conducted in five cotton mills in Sweden. All personnel in the areas for bale opening, carding and spinning was interviewed by means of questionnaire based on the Medical Research Council Questionnaire (1963). The persons reporting chest tightness on Mondays or after return from

vacation or leave were classified as byssinotics. Those who demonstrated symptoms in the airways related to the beginning of work on Monday, such as cough, irritation, tightness in the throat or breathing difficulties, were also classified as byssinotics. The workers were classified as having chronic bronchitis when they indicated a cough with phlegm for more than 3 years, with periods of coughing longer than 3 months within a one-year period.

The dust levels in the different working areas were determined by filtering air through Millipore filters with a metal grid to catch larger fibres, etc. The number of airborne Gram-negative rods was determined with an Andersen sampler with Drigalski agar as a selective medium.

All measurement were performed 2 to 3 times during different time periods of the day, at two different sites, in different working areas.

RESULTS

The dust levels in the different areas varied between 0.3 and 2 mg/m³. The levels were highest in the card rooms. The number of Gram-negative bacteria varied between 5 and 112 per litre air. These values were also highest in the card rooms. The correlation between the dust level and the bacteria was high ($r_{xy} = 0.96$). A tendency to a proportionally lower number of bacteria per mg dust was found in the spinning areas.

A total of 243 persons were interviewed in the investigation with almost an equal distribution between females and males. The drop-out from the original sample was 14%, consisting of persons on vacation or workers who had left work during the period of investigation. Only four workers refused to participate. There was no difference between the interviewed and the drop-out group concerning age and time of employment. The age distribution was relatively equal over different age groups. More than half of the workers had been employed less than 10 years.

Table 1 shows the prevalence of byssinosis and chronic bronchitis and the time of employment. The extent of byssinosis was related to the length of employment.

TABLE 1
The prevalence of byssinosis and chronic bronchitis and time of employment.

Employment years	Number of workers				
	Interviewed	With byssinosis		With chronic bronchitis	
	N	N	%	N	%
< 9	131	17	13	9	7
10-19	37	9	24	6	16
20-29	23	10	43	1	4
30-39	25	5	20	2	8
> 40	27	7	26	1	4

Table 2 demonstrates the extent of byssinosis and chronic bronchitis among female and male workers in the investigated population. It is seen that the proportion of byssinosis was higher among male workers than among the female. This cannot be explained by differences in tobacco-smoking. Chronic bronchitis was found in 8% of the workers and no significant difference between the sexes was observed.

TABLE 2
The prevalence of byssinosis and chronic bronchitis among female and male workers.

	Number of workers				
	Interviewed	With byssinosis		With chronic bronchitis	
	N	N	%	N	%
Women	118	15	13	8	7
Men	125	33	26	11	9
Total	243	48	20	19	8

Table 3 demonstrates the extent of byssinosis and chronic bronchitis among non-smokers and smokers. Byssinosis was present among 18% of the non-smokers. The proportion of byssinotics was not higher among cigarette smokers and no increase in the extent of byssinosis was found with an increasing tobacco consumption. Six per cent of the non-smokers had symptoms of chronic bronchitis and a slightly higher prevalence was found among the heavy smokers.

TABLE 3
The prevalence of byssinosis and chronic bronchitis among non-smokers and smokers.

	Number of workers					
	Interviewed	With byssinosis		With chronic bronchitis		
	N	N	%	N	%	
Non-smokers	131	24	18	8	6	
Smokers (cigarettes per day)	1- 5	21	4	19	0	0
	6-14	33	8	24	3	9
	≥ 15	58	12	21	8	14

Table 4 demonstrates the extent of byssinosis and chronic bronchitis at different working sites in the industries. The highest prevalence was present in the bale opening areas with successively lower values for card room and spinning areas. The differences were not significant.

TABLE 4
The prevalence of byssinosis and chronic bronchitis at different working sites.

	Number of workers				
	Interviewed	With byssinosis		With chronic bronchitis	
	N	N	%	N	%
Bale opening	18	5	28	2	11
Card	66	16	24	6	9
Spin	159	27	17	11	7

Table 5 shows the relationship between the extent of byssinosis and the dust level and the number of airborne Gram-negative bacteria in different exposure groups. It is seen that a dose-response relationship was present both for dust levels and bacteria.

TABLE 5
The prevalence of byssinosis, dust levels and number of airborne Gram-negative bacteria in different exposure groups.

mg/m ³		≤ 0.4	0.5–0.9	1.0–1.5	≥ 1.6
Interviewed	N	127	78	26	9
Byssinosis	N	19	13	10	5
	%	15	17	38	56
Bacteria/l		≤ 20	21–50	51–80	≥ 81
Interviewed	N	145	40	49	9
Byssinosis	N	20	11	12	5
	%	14	28	25	56

DISCUSSION

The techniques used in the present study to evaluate the presence of byssinosis and chronic bronchitis as well as to determine the exposure levels were standard techniques, used previously in other investigations. The results demonstrate that the symptoms of byssinosis were recorded among 20% of the workers in the investigated cotton mills. Byssinosis was found also in the areas where the dust level was between 0.3 and 0.4 mg/m³. In comparison with the studies of byssinosis in other countries, the dust levels found in the Swedish mills were generally lower, which explains a relatively low prevalence of byssinotic symptoms as compared to other investigations¹.

The absence of a relationship between the prevalence of byssinosis and smoking habits is in discordance with observations in other studies^{4,5}. A possible explanation is that the dust levels, as well as the number of cigarettes smoked was relatively low in comparison with other reported data. The threshold for a synergistic effect may thus not have been reached. The number of persons

investigated was also relatively small, which could imply that an increased risk due to a synergistic effect was not detected because of a statistical variation among the subjects.

A close correlation between the dust level and the number of airborne bacteria in the different industries made a separate evaluation of the relative importance of these two factors impossible. For the studied population, the risk of byssinosis could equally well be expressed using the dust level as the number of airborne Gram-negative bacteria.

In conclusion, the study has demonstrated the presence of byssinosis in a population in Swedish cotton mills. The extent of the symptoms is related to the length of employment, but cases of byssinosis were also found among persons who only worked a few years. No relationship was found between smoking habits and the extent of byssinosis, but a tendency towards a relationship was demonstrated for chronic bronchitis. The risk of development of byssinosis in the factories could equally well be related to the dust levels as to the number of airborne Gram-negative bacteria.

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