
Editorial

Byssinosis in developing countries

Byssinosis is a chronic respiratory disease that is seen among workers exposed to cotton, flax, and soft hemp dust. Cotton processing employs many workers throughout the world and carries the maximum risk of byssinosis in initial processes of yarn manufacture. The disease was reported in the 18th and 19th centuries and systematic epidemiological studies were undertaken in the 1950s by Schilling and his colleagues in the United Kingdom. Reach and Schilling¹ reported a high prevalence (63% in men and 48% in women) in cardroom workers of Lancashire cotton mills processing coarse cotton. Similar findings have since been published from many other countries where cotton is processed. Among cardroom workers, El Batawi reported a prevalence of 27% in Egypt and Belin *et al* a prevalence of 25-60% in Sweden.^{2,3} Prevalences of 21% and 88% were reported by Valic and Zuskin for Yugoslavia,^{4,5} 11% by Tuypens for Belgium,⁶ and 11%, 26%, and 38.4% by Bouhuys *et al*⁷ and Merchant *et al*⁸ for the United States. It is evident from all of these studies that the occurrence of the disease varied considerably. This was explained by the type of cotton processed (namely, coarse, medium, and fine), concentration of cotton dust in the work environment, duration of exposure, and smoking habits.

In the last few years the disease has shown a declining trend due to the introduction of dust control in the textile mills of developed countries. Cinkotai *et al* found a 10% prevalence of byssinosis in cardroom workers, 3% in spinning room workers, and 3% in winders in the United Kingdom.⁹ In a recent report from the United Kingdom, only 23 new cases of byssinosis were reported in 2101 cases of occupational respiratory diseases in 1989.¹⁰ In the United States strict hygiene standards were enforced in 1978, and these have also reduced the incidence of this disease. In developing countries, however, byssinosis is still found in a high percentage of textile workers, as the following summary indicates:—

India

Three recent studies in different places suggest a high prevalence of byssinosis. The first study was carried out at Ahmedabad by Parikh *et al*¹¹ in three textile mills processing a medium variety of cotton where 929 workers from the spinning department were examined. The results showed a mean prevalence of 30% in blowrooms and 38% in cardrooms. The cotton dust concentrations (dust after removal of fly)

measured by cone samplers were 6-8 times higher than the permissible concentrations recommended by the British Occupational Hygiene Society.¹² This higher prevalence of byssinosis compared with earlier Indian studies showed that if correct methods are not used in epidemiological surveys, the investigators are likely to report a low prevalence of the disease. The second study carried out by Gupta and Gupta¹³ in Delhi in a mill processing a coarse variety of cotton found the following prevalences: blowroom 37%, cardroom 47%, spinning 17%, weaving 22%, and finishing 7%. The study used only questionnaires to detect cases and neither pulmonary function tests nor dust measurements were included. The third study,¹⁴ was carried out in Kishangarh, Rajasthan, in a mill processing coarse and synthetic yarn. Among 616 workers examined the prevalence of byssinosis found was blowroom 28%, cardroom 30%, drawframe 26%, ringframe 20%, and winding 25%. The higher prevalence rates reported in sections other than in blowrooms and cardrooms in the second and third study could have been due to the coarse variety of cotton or the closeness of these sections to cardrooms.

South Africa

White¹⁵ examined 2411 textile workers in six textile mills. The prevalence of byssinotic symptoms was highest (44%) among bale opening and blowroom workers. These workers also showed the largest mean change in forced expiratory volume in one second (FEV₁) across a shift (6%). The concentration of cotton dust in these areas was above the World Health Organisation recommended permissible exposure concentration of 0.2 mg/m³.¹⁶ A lower prevalence (5%) in the card section was attributed to local exhaust ventilation in two mills and the use of fine cotton in one mill. In the ringframe section the prevalence was 7%. An important feature of this study was the finding of workers with pulmonary tuberculosis in relation to byssinosis. The prevalence of byssinosis symptoms was not increased, although FEV₁, forced vital capacity (FVC), and FEV₁/FVC% were lower in these workers.

Central Africa

In a preliminary study by Takam and Nemary,¹⁷ carried out in a textile factory in Cameroon, 125 exposed and 68 control workers were examined. The total dust concentrations in opening, carding, and

spinning sections were 9.6, 9.3, and 8.2 mg/m³ respectively. The overall prevalence of byssinosis in these sections was 28%, and was more common in smokers than in non-smokers.

Ethiopia

Woldeyohannes *et al*¹⁸ examined 322 men and 273 women randomly selected from a total of 1470 workers engaged in dusty operations of a textile mill. Dust concentrations measured by a vertical elutriator ranged from 0.86 to 3.52 mg/m³ in different sections of the mill. These concentrations were 4–17 times higher than the permissible concentration of 0.2 mg/m³ recommended in 1983 by the American Conference of Government Hygienists (ACGIH).¹⁹ Prevalence rates of byssinosis were: blowing 43%, carding 38%, drawing 24%, simplex 24%, ringframe 17%, preparatory 11%, and weaving 4%. The prevalence of chronic bronchitis ranged from 18% to 48%. A high prevalence of bronchial asthma (11%) was a surprising finding not reported in other studies of byssinosis.

Sudan

Two studies from Sudan by the same investigators^{20,21} showed a high prevalence of byssinosis. The first study in a textile mill that processed coarse cotton included 311 male workers from various sections. Prevalence rates reported were: blowing 67%, carding 40%, drawframe 40%, simplex 42%, and ringframe 37%. Chronic bronchitis rates ranged between 29% and 47%. Byssinosis was more frequent among smokers than non-smokers and increased with duration of exposure. Pulmonary function tests showed a significant fall in FEV₁ during the shift among symptomatic and asymptomatic workers with chronic changes more common among byssinotic than non-byssinotic workers. The second study was in two textile mills located in Khartoum and Hassaheisa, the first of which processed coarse cotton, and the second a fine grade. The overall rates of byssinosis in Khartoum and Hassaheisa were 37% and 1% and rates of chronic bronchitis were 29% and 2% respectively. A significant reduction in FEV₁ was seen after a shift in both the mills. The results of this study indicate that the prevalence of byssinosis and other respiratory symptoms was related to the type of raw cotton processed and to the concentrations of cotton dust.

Egypt

Noweir *et al*²² examined 506 male workers in an Egyptian textile mill in Alexandria. The prevalence of byssinosis was 21% in opening and cleaning sections and 13% in carding and combing rooms. No case of byssinosis was found in drawing, twisting, and spinning operations. The low prevalence of

byssinosis in opening, cleaning, and carding rooms was attributed to the fine quality of cotton processed.

Prevalence was related to duration of exposure except for exposure periods longer than 30 years. Cotton dust concentrations were four to 20 times higher than the threshold limit value recommended by ACGIH (1983). Reduction in FEV₁ at the end of the shift after a weekend break occurred more often than byssinosis. Smoking had no effect on either the prevalence of byssinosis or the reduction in FEV₁.

China

A study was carried out by Christiani *et al*²³ of 887 workers from the yarn preparation areas of two cotton textile mills in Shanghai. Diagnostic criteria and pulmonary function equipment were similar to those used in the United States and England so that results could be compared with those previously reported. Cotton dust concentrations measured by vertical elutriator ranged from 0.45 to 1.56 mg/m³. The overall prevalence of byssinosis was 8% but no analysis was published for different sections. Workers with byssinosis complained more of chronic bronchitis and cough than those without byssinosis. Most cases of byssinosis were mild (grades 1/2 to 1) and byssinosis was reported more often by non-smoking women (11%) than non-smoking men (1%). Explanations suggested by the authors for the low prevalence and mild nature of symptoms included young age, short duration of exposure, the use of medium to fine hand picked cotton with low trash and leaf content, and the removal of workers with diseases such as tuberculosis and asthma. It was suspected that some cases of asthma were in fact cases of byssinosis. In two studies of carders in Hong Kong quoted by Ong *et al*²⁴ prevalences of 59% and 74% were reported.

Thus it is clear that byssinosis occurs in a high percentage of textile workers in developing countries, mainly due to the unawareness of government, unions, doctors, workers, and employers regarding this disabling disease. There is seldom provision for pre-employment or periodical examinations for textile workers in the health services of these countries. As the diagnosis of byssinosis is made by a questionnaire, it is necessary that correct methods are used in the epidemiological surveys. In my experience it is difficult to translate "chest tightness" accurately into other languages. Although chest tightness is experienced by most byssinotic workers, it is not expressed as clearly in other languages as in English. Most byssinotic workers complain of breathing difficulties or shortness of breath related to work on the first day of the week after a weekend break, during which they have little or no respiratory complaint. To assess Monday sickness accurately, it is therefore necessary for epidemiological surveys to be arranged on the first day after a weekend break.

An important problem for textile workers in developing countries is pulmonary tuberculosis; many workers with this disease are employed in the dusty sections of textile mills. Although no relation has been found between tuberculosis and byssinosis, exposure to cotton dust is clearly not desirable and those affected should be transferred to dust free sections.

The reduction in dust concentration by control devices is the most important step in the prevention of byssinosis, but at present such devices are unknown in developing countries. Because the bract is considered to contain agents responsible for the disease, attempts should be made to harvest clean cotton. To some extent hand pickers can be trained to reduce the bract content but experiments are needed to test the efficacy of this. Research should also continue to identify the exact agents in cotton dust responsible for byssinosis, whereby prevention might be achieved more easily.

I acknowledge the help of Mr A R Shah in the preparation of this article.

JR PARIKH

National Institute of Occupational Health,
Ahmedabad—380 016
India

- 1 Roach SA, Schilling RSF. A clinical and environmental study of byssinosis in the Lancashire cotton industry. *Br J Ind Med* 1960;17:1-9.
- 2 El Batawi MA. Byssinosis in the cotton industry in Egypt. *Br J Ind Med* 1962;19:126-30.
- 3 Belin L, Bouhuys A, Hoeskstra W, Johnson M, Lindell SE, Pool J. Byssinosis in cardroom workers in Swedish cotton mills. *Br J Ind Med* 1965;22:101-8.
- 4 Valic F, Zuskin E. A comparative study of respiratory function in female non-smoking cotton and jute workers. *Br J Ind Med* 1971;28:364-8.
- 5 Valic F, Zuskin E. Effects of different vegetable dust exposures. *Br J Ind Med* 1972;29:293-7.
- 6 Tuypens E. Byssinosis among cotton workers in Belgium. *Br J Ind Med* 1961;18:117-9.
- 7 Bouhuys A, Wolfson RL, Horner DW, Brain JD, Zuskin E. Byssinosis in cotton textile workers. *Annals of Industrial Medicine* 1969;71:257-69.
- 8 Merchant JA, Lumsden JC, Kilburn KH, et al. Dose response studies in cotton textile workers. *J Occup Med* 1973;15:222-30.
- 9 Cinkotai FF, Rigby A, Pickering CAC, Seaborn D, Faragher E. Recent trends in the prevalence of byssinotic symptoms in the Lancashire textile industry. *Br J Ind Med* 1988;45:782-9.
- 10 Meredith SK, Taylor VM, McDonald JC. Occupational respiratory disease in the United Kingdom 1989: a report to the British Thoracic Society and the Society of Occupational Medicine by the SWORD project group. *Br J Ind Med* 1991;48:292-8.
- 11 Parikh JR, Bhjagia LJ, Majumdar PK, Shah AR, Kashyap SK. Prevalence of byssinosis in textile mills at Ahmedabad, India. *Br J Ind Med* 1989;46:787-90.
- 12 British Occupational Hygiene Society Committee on Hygiene Standards sub-committee on vegetable textile dusts. Hygiene standards for cotton dust. *Ann Occup Hyg* 1972;15:165-92.
- 13 Gupta Saroj, Gupta BK. A study of byssinosis and associated respiratory disorders in cotton mill workers. *Ind J Chest Dis Allied Sci* 1988;28:183-8.
- 14 Barjatiya MK, Mathur RN, Swroop A. Byssinosis in cotton textile workers of kishangarh. *Ind J Chest Dis Allied Sci* 1990;32:215-23.
- 15 White NW. Byssinosis in South Africa. A survey of 2411 textile workers. *S Afr Med J* 1989;75:435-42.
- 16 World Health Organisation Study Group. *Recommended health based occupational exposure limits for selected vegetable dusts*. Geneva: WHO, 1983. (Tech Rep Series No 684.)
- 17 Takam J, Nemery G. Byssinosis in a textile factory in Cameroon: a preliminary study. *Br J Ind Med* 1988;45:803-9.
- 18 Woldeyohannes M, Bergevin Y, Mgeni AY, Theriault G. Respiratory problems among cotton textile mill workers in Ethiopia. *Br J Ind Med* 1991;48:110-5.
- 19 American Conference of Governmental Industrial Hygienists. *Threshold limit values*. Cincinnati: ACGIH, 1983.
- 20 Awaad Elkarim MA, Osman Y, El Haimi YAA. Byssinosis: environmental and respiratory symptoms among textile workers in Sudan. *Int Arch Occup Environ Health* 1986;57:101-8.
- 21 Awaad Elkarim MA, Onsa Suliman H. Prevalence of byssinosis and respiratory symptoms among spinners in Sudanese cotton mills. *Am J Ind Med* 1987;12:281-9.
- 22 Noweir MH, Noweir KH, Osman HA, Moselhi M. An environmental and medical study of byssinosis and other respiratory conditions in the cotton textile industry in Egypt. *Am J Ind Med* 1984;6:173-83.
- 23 Christiani DC, Eisen EA, Wegman DH, et al. Respiratory disease in cotton textile workers in the People's Republic of China. 1. Respiratory symptoms. *Scand J Work Environ Health* 1986;12:40-5.
- 24 Ong SG, Lam TH, Wong CM, et al. Byssinosis in Hong Kong. *Br J Ind Med* 1985;42:499-502.