Byssinosis: environmental and respiratory symptoms among textile workers in Sudan

Mohamed A. Awad El Karim¹, Y. Osman², and Yousif A. A. El Haimi²

¹ Department of Community Medicine, Faculty of Medicine, University of Khartoum, Sudan
² Department of Occupational Health, Ministry of Health, Khartoum, Sudan

Summary. This study has been carried out to investigate the prevalence of byssinosis and other respiratory symptoms among 311 Sudanese workers in different sections of the Khartoum Weaving and Spinning Company. The prevalence of byssinosis was 67% among blowers, 40% in carders and draw-frame workers, 42% in simplex workers and 37% in ring-frame workers. The prevalence of chronic bronchitis ranged between 29 to 47% in all groups. A significant fall in FEV₁ was recorded in carders and draw- and ring-frame workers. There was also a statistically significant decrease in FVC after shift in all groups except in the ring-frame group. The result of the present study revealed that the prevalence of byssinosis was very high in mills processing coarse cotton. Application of control measures and the early detection of exposure effects will reduce the prevalence of byssinosis and other respiratory impairments.

Key words: Byssinosis – Environmental assessment – Respiratory impairment – Textile workers – Cotton dust

Introduction

The deleterious effects of cotton dust exposure on ventilatory capacity and the respiratory system have been reported from many countries (Schilling et al. 1955; Bouhuys et al. 1969; Zuskin et al. 1969). The prevalence of byssinosis and other respiratory symptoms, such as bronchitis and impairment of pulmonary functions, are increasing rather than decreasing among African workers exposed to vegetable dust (El Batawi et al. 1964; Mustafa et al. 1978). Several studies have been conducted among workers exposed to cotton dust at ginning and early stages of cotton yarn processing (El Batawi 1962; Khogali 1969). Few
studies have been carried out among workers in the other textile operations, such as drawing, simplex and spinning (Noweir et al. 1984; Awad El Karim and El Hag 1985). We investigated the prevalence of byssinosis and other respiratory symptoms among workers exposed to cotton dust in a textile mill in Sudan.

**Materials and methods**

Three hundred and eleven male workers (age 17–58 years) comprising 25% of the total workforce in blowing, carding, draw-frames, simplex and ring-frame operations in a textile mill in Khartoum North, Sudan were randomly selected and examined. Workers were interviewed to gather information on age, social and personal conditions, smoking habits, duration of work and occupational history and experience.

**Air sampling**

The concentrations of the total dust (all particle sizes) and respirable fraction of the dust (particles of 7 μ equivalent diameter) in the surveyed sections were determined. Two sets of Hexlets with elutriators positioned at the breathing zone about 1.5 m above the floor level were used. Elutriators were calibrated before sampling and the critical orifices used to control the flow rates were calibrated against flow meter. The majority of samples were taken over 4-h periods, however, the shortest period was 3.5 h and the longest 7 h (mean 5.5 h). All samples were collected on glass fibre filters of 5.5 cm diameter to fit the sampling heads. Filters were weighed individually before and after sample collection. Weighing was carried out in a sensitive balance after equilibrating filters in the laboratory for 24 h under conditions of similar temperature and relative humidity.

**Medical examination and lung function**

Each worker was interviewed and examined by one physician without prior knowledge of the worker's section. A modified British Medical Research Council Questionnaire on respiratory symptoms (MRC 1960) was completed. As Saturday is the first working day of the week in Sudan, byssinosis was classified according to the criteria described by Schilling et al. (1963) as follows:

- Grade 0: No evidence of Saturday cough, chest tightness or breathing difficulty.
- Grade ½: Occasional chest tightness or breathing difficulty on Saturday.
- Grade I: Chest tightness or breathing difficulty every Saturday.
- Grade II: Chest tightness or breathing difficulty on Saturday and other days of the week.

Chronic bronchitis was defined as coughing and phlegm for at least three months each year for not less than two successive years, chronic coughing and/or phlegm were defined as coughing and/or phlegm production on most days for at least three months per year.

Subjects' forced expiratory volume in one second (FEV₁) and forced vital capacity (FVC), before and after shift, were measured using a vitalograph spirometer. The manoeuvres of measuring FEV₁ and FVC were explained and demonstrated to each subject. The highest two out of five recorded expiratory efforts were averaged to estimate the FEV₁ and FVC. All volumes were corrected to body temperature and pressure saturated with water vapour (BTPS). The tests were performed on the first day of the shift after at least one day of absence from work. Predicted normal values of FEV₁ and FVC for each subject were obtained by substituting the mean age and height in the following linear regression equations (for normal Africans, Mustafa 1977).

\[
\text{FVC} = 0.064 \text{Hcm} - 0.016 \text{A} - 6.14
\]

\[
\text{FEV}_1 = 0.046 \text{Hcm} - 0.022 \text{A} - 3.864
\]