

Effects of Long Term Exposure of Cotton Dust on Physiological and Anthropometric Profiles of Cotton Mill Workers in Phagwara, Punjab

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ABSTRACT The present paper deals with the relationship of physiological and anthropometric measurements and long term exposure of cotton mill workers of Phagwara, Punjab. The samples were measured for physiological measurement, viz., vital capacity and anthropometric measurements, viz., weight, stature, sitting height, upper arm circumference and chest circumference and were compared with an appropriate control. Results indicate significant declination for all the measurements (except stature) in cotton mill workers of age group 41 years onwards, as compared to the controls.

INTRODUCTION

Long term exposure of cotton dust have adverse affect on the health of textile workers. Several studies have shown a progressive decline in worker's forced expiratory volume (FEV1) in relation to exposure to cotton dust (Beck et al., 1982; Bhagia et al., 1990; Parish et al., 1990; Valazquez, 1991; Beckett et al., 1994 and Jennison et al., 1994). Some of these declines are such that one would anticipate a very poor survival rate among the workers. However, mortality studies have failed to show that cotton dusts have anything other than a normal life expectancy with no apparent excess of deaths from chronic respiratory diseases (Berry and Molynenx, 1981; Elwood et al., 1982). After several years of exposure to cotton dust, persons may develop byssinosis. The patients complaint chest tightness, fever, aches, chest pains, dry cough, wheeze and breathlessness resembling allergic alveolitis. The prevalence of byssinosis among persons working in cot-

ton waste industries have been reported in subsequent studies (Docker et al., 1991; Woldeyohannes et al., 1991 and Sigagaard et al., 1992).

Raw cotton easily becomes contaminated by fungi and gram negative bacteria. Fungal overgrowth may well be responsible for cough and gram negative bacterial endotoxin for byssinosis. De Lucca et al. (1991) studied the biophysical relations of lung surfactant by extracts of cotton dust. Some types of cotton appear to be worse than the others and dustier parts of the production process tend to cause several bronchopulmonary diseases.

Considering these views, in the present paper efforts have been made to explore the effects of long term exposure of cotton dust on vital capacity and some anthropometric measurements of the cotton mill workers of Phagwara, Punjab.

MATERIAL AND METHOD

A total of 95 male cotton mill workers were sampled from Jagatjit Cotton Mill, Phagwara, Punjab, India. They were divided into three age groups, i.e., 20-30 years, 31-40 years and 41 years onwards. From the same area 96 unrelated normal healthy individuals, comparable to the workers in all aspects except the occupation were sampled randomly as controls. Physiological measurement, viz., vital capacity, the anthropometric measurement, viz., body weight, stature, sitting height, upper arm circumference and chest circumference were taken into account for the present study.

Vital capacity was measured in sitting position with Riester's Portable Spirometer following standard technique (Weiner and Lourie, 1969) and all the anthropometric measurements were taken as described by Singh and Bhasin (1989). Standard statistical calculations were made for comparison.

RESULTS AND DISCUSSION

Table 1 shows the comparison of the vital capacity values in cotton mill workers and normal individuals. Mean values of vital capacity in cotton mill workers are lower in all age groups than the normal individuals and highly significant differences ($P < 0.001$) have been observed between these two sets of population in all the age groups.

Table 2 shows the comparison of some anthropometric measurements between cotton mill workers and normal individuals. In case of weight, significant difference has been found only in the age group of 41 years onwards. In case of stature no difference is found in any age group. Regarding sitting height, significant differences are observed in the age group of 31-40 years and 41 years onwards between exposed workers of cotton mill and controls. In case of upper arm circumference, once again, statistically significant difference ($P < 0.05$) is noted in the age group 31-40 years and highly significant differences ($P < 0.001$) has been found in the age group of 41 years onwards between these two populations. About chest circumferences, only in the age group of 41 years onwards,

Table 1 : Comparison of Vital Capacity Values between cotton mill workers and normal individuals

Age group (in years)	Cotton Mill Workers			Normal Individuals			t' values
	N	$\bar{X}$	SD	N	$\bar{X}$	SD	
20-30	32	2506.25	224.91	36	2700.00	218.58	3.595*
31-40	31	2303.22	253.34	30	2623.33	305.16	4.452*
41+	32	1973.33	310.84	30	2416.67	285.29	5.859*

* $P < 0.001$

Table 2 : Comparison of some anthropometric measurements between cotton mill workers and normal individuals

Measurements	Age group (in years)	Cotton Mill Workers					Normal Individuals					t' values
		N	$\bar{X}$	SEM	SD	SESD	N	$\bar{X}$	SEM	SD	SESD	
Weight	20-30	32	54.86	+1.43	7.96	+1.00	36	57.39	+1.35	8.00	+0.95	1.304
	31-40	31	57.03	+2.24	12.20	+1.56	30	58.60	+1.44	7.76	+1.01	0.604
	41+	32	56.01	+1.46	8.15	+1.03	30	59.97	+1.25	6.76	+0.88	2.082*
Stature	20-30	32	164.81	+1.12	6.26	+0.79	36	164.79	+0.78	4.60	+0.55	0.016
	31-40	31	163.81	+1.21	6.61	+0.85	30	165.51	+0.73	5.16	+0.67	1.119
	41+	32	164.07	+1.09	6.05	+0.82	30	165.56	+1.04	5.63	+0.73	0.999
Sitting Height	20-30	32	83.65	+0.77	4.30	+0.54	36	83.61	+0.83	4.91	+0.58	0.860
	31-40	31	83.89	+0.60	3.30	+0.42	30	85.52	+0.53	2.83	+0.37	2.075*
	41+	32	83.37	+0.47	2.64	+0.33	30	84.81	+0.44	2.38	+0.31	2.236*
Upper arm Circumference	20-30	32	23.24	+0.41	2.29	+0.29	36	24.12	+0.39	2.29	+0.27	1.575
	30-40	31	24.07	+0.47	2.55	+0.33	30	25.31	+0.40	2.15	+0.28	2.056*
	41+	32	23.42	+0.29	1.59	+0.20	30	25.39	+0.32	1.73	+0.22	4.649***
Chest Circumference	20-30	32	83.13	+0.92	5.12	+0.64	36	84.90	+0.99	5.86	+0.70	1.084
	30-40	31	83.73	+1.00	5.89	+0.75	30	84.86	+1.02	5.50	+0.72	0.768
	41+	32	84.49	+0.79	4.42	+0.56	30	87.59	+0.71	3.83	+0.50	2.937**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

significant difference ($P < 0.01$) in observed between them.

In the present study, striking decline in vital capacity has been observed in cotton mill workers. This observation supports the several earlier (Parish et al., 1990; Woldeyehannes et al., 1991; Sigagaard et al., 1992 and Jennison and Jacob, 1994). Moreover, the decline is more severe in the age group of 41 years onwards. Thus we may conclude that long term exposure of cotton dust may have some association with the decline of vital capacity.

Cotton dust may alter the biophysical characteristics of the lung surfactant (De Lucca et al., 1991, 1992). In fact, surfactant may somehow be responsible for alveolar collapse. The cotton dust itself may act as antigenic agent and cause the immunologic response (Rylander, 1985 and Buick et al., 1994). Thus the association of long term exposure of cotton dust with the declination of vital capacity of the cotton mill workers may cause several bronchopulmonary diseases too.

The altered effects on anthropometric measurements are related to the decline of lung function in cotton mill workers. Impairment of lung function may adversely effect the oxygenation of blood as well as the cell respiration and thus in turn metabolism. Impairment of metabolism may adversely effect the building up of fats, proteins and other body constituents, specially after prolonged exposure of cotton dust as evident from the present study.

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