

PULMONARY FUNCTION STUDIES IN PAKISTANI COTTON GINNERS

Saadat Ali Khan Aiza Saadia*

Department of Physiology, Foundation University Medical College Rawalpindi Pakistan and *Department of Paediatrics, Military Hospital Rawalpindi

Background: The present study explored the relationship between the pulmonary functions and exposure to cotton dust. Pulmonary function tests i.e. forced vital capacity (FVC), forced expiratory volume in first second (FEV₁), and peak expiratory flow rate (PEFR) were recorded in 64 non smoker cotton ginnners. The data on pulmonary function test for healthy Pakistani population from previous studies was used as control. The follow-up study for lung function testing on the same cotton ginnners was conducted from 1999 and repeated yearly up to 2005. Because of cotton dust exposure, cotton ginnners showed a significant decline in their pulmonary function ($P < 0.05$). **Conclusion:** We concluded that the continuous exposure to cotton dust in ginnners is associated with an increased progressive impairment of pulmonary functions.

Keywords:

INTRODUCTION

It is well known that exposure to cotton dust may cause respiratory symptoms including characteristic byssinosis, symptoms of chest tightness on the first working day after absence from routine cotton work.¹⁻⁴ Numerous cross-sectional⁵⁻⁷ and longitudinal studies⁸⁻¹⁰ have described the high prevalence of chronic respiratory symptoms and byssinosis in cotton workers along with the acute effects of cotton dust on pulmonary functions.¹¹ By contrast there have been hardly any studies examining the development of pulmonary impairment in Pakistani cotton workers.

No doubt, cotton is one of the main cash crops of Pakistan. Thousands of workers are exposed to cotton dust while busy in collecting cotton from the fields and in large textile mills during carding, blowing, spinning and weaving.¹² Hundreds of cotton ginnners earn their living by classical "Farfara/pinjara" type of local ginning method in houses and on the streets. All of these workers specially cotton ginnners are exposed to cotton dust, quite freely and frequently, which is a major threat to their pulmonary health.^{13,14}

A number of investigations have examined the relationship between relative losses of pulmonary functions and cotton exposure in textile workers and ginnners. Very serious, irreversible changes in pulmonary function along with life threatening conditions associated with cotton exposure, have been mentioned, regularly in medical literature.¹⁵⁻¹⁸ We sought to delineate the relationship between pulmonary function loss and cotton ginning, using a cohort of elderly active, relatively middle aged and young cotton ginnners, constituting some family trends in adopting the profession of cotton ginning, however randomized selection of cotton ginnners was involved very frequently in this study.

The current study is unique as it includes the survey of socio-economic background and family

trend in the occupation of cotton ginning, and defines not only the decline of pulmonary functions due to exposure to cotton dust, at the same time it attempts to develop a piece of advice for cotton ginnners in terms of protective measures against byssinosis.

MATERIALS AND METHODS

Sixty-four cotton ginnners from Karachi and Rawalpindi region were selected whose age ranged between 19.5 and 63.5 years (mean 36.4 +/- 9.82 years). At the beginning of survey almost all the subjects were involved in the profession of cotton ginning, at least for the one year. None of the subject had been a regular smoker. All the subject were explained fully about the aims of the study and written consent for participation in the study was obtained from each of them.

A questionnaire was used to record personal data and socio-economic conditions. Care was observed not to include subjects suffering from any major diseases other than pulmonary system. Subjects were instructed during orientation to the use of vitalograph - compact, a portable electronic spirometer. Before testing, the purpose and techniques of management were explained to every subject, and they were given sufficient practice in the use of the instrument. Pulmonary functions were recorded i.e. FVC, FEV₁, and PEFR. During the recording, protocol of International Spirometry procedure^{19,20} was strictly followed.

The data was subjected to standard statistical analysis. Student's 't' test was used to compare the values of pulmonary function tests for cotton ginnners, using the standard lung function test values of healthy Pakistani individuals of similar age group as controls.¹⁻³ A comparison of the pulmonary function test value for the follow-up study was also carried out to evolve the variable in terms of lung function of cotton ginnners during 1999 and subsequently during 2005, to admire the serial effects of continuous

exposure to cotton dust. The value of $P < 0.05$ was considered as statistically significant.

Pulmonary functions were recorded for the same cotton ginner during 1999 and once again during 2005. However, the number of cotton ginner we could successfully follow decreased respectively from 82 to 64 during the year 2005.

RESULTS

The group-wise age distribution and body mass index (BMI) cotton ginning population registered and followed during the study is shown in Table-1. Socio economic background and family trends in term of number generations involved in occupation of Cotton Ginning during the study is shown in Table-2. The recorded values of pulmonary function test for cotton ginner according to different age groups during 1999 are shown in Table-3 and the same data for the year 2005 is shown in Table-5. Exposure to cotton dust is associated with statistically significant fall in FVC,

FEV₁ and PEFR. Table-4 shows the comparison of PEFR and FEV₁/FVC% measured in cotton ginner as compared-with standard healthy controls. This significant decline ($P < 0.05$) in lung function test values for cotton ginner as compared to standard healthy control in identical age group is specific in relatively younger cotton ginner. Table-6 shows the comparison of PEFR and FEV₁/FVC% measured during the year 1999 and then in the year 2005 in Cotton ginner and also shows a significant fall in PEFR ($P < 0.5$), in cotton ginner as a result of continuous exposure to cotton dust from the year 1999 to year 2005 except in age group of above sixty years. This comparative state suggest that continuous exposure to cotton dust shows a significant decline in pulmonary functions ($P < 0.5$). However, a remarkable protective trend in pulmonary function test values is observed in the cotton ginner who are involved in this profession for relatively longer periods.

Table-1: Age-wise distribution and body mass index (BMI) of cotton – ginner during follow-up-study

AGE GROUP	No. of Subjects		No. of Subjects	
	1999	BMI	2005	BMI
20-30 YRS	14	22.24±2.14	9	23.18±2.42
31-40 YRS	23	21.88±2.56	21	22.66±1.92
41-50 YRS	17	22.72±2.46	15	22.94±2.86
51-60 YRS	15	21.64±3.12	11	22.42±1.76
>60 YRS	13	22.12±2.52	08	22.06±1.98
TOTAL	82		64	

Table-2: Socio economic background and family trend in the occupation of cotton – ginner (final sample) during the – study (n=64)

AGE GROUP	No. of Cotton Ginner	AVERAGE - FAMILY SIZE	AVERAGE – INCOME/DAY	GENERATIONS
20-30 YRS	9	3.8±1.2 Persons	Rs: 92.00±36.4	2-3
31-40 YRS	21	4.8±1.6 Persons	Rs: 116.00±28.6	2-3
41-50 YRS	15	5.2±1.6 Persons	Rs: 118.00±40.8	1-2
51-60 YRS	11	4.6±2.2 Persons	Rs: 88.00±32.2	3-4
>60 YRS	08	5.4±2.8 Persons	Rs: 102.00±28.2	3-4
TOTAL	64			

Table-3: Pulmonary functions of cotton ginner (1999)

AGE GROUPS	FVC (l)	FEV1 (l)	FEV ₁ /FVC %	PEFR (l)
20-30 YRS	3.35±0.62	2.38±0.51	70.2	448.2±48.6
31-40 YRS	3.84±0.56	2.49±0.47	68.4	463.5±28.4
41-50 YRS	4.08±0.38	2.84±0.38	66.8	482.6±44.5
51-60 YRS	4.22±0.58	2.95±0.72	70.6	476.8±12.4
> 60 YRS	3.56±0.44	2.88±0.46	71.4	436.4±52.2

Table-4: Comparison of pulmonary functions of cotton ginner and standard healthy individuals at the beginning of the study (1999)

Age Groups	(PEFR l/min)			FEV1/FVC %		
	COTTON GINNERS	HEALTHY CONTROLS	P Value	COTTON GINNERS	HEALTHY INDIVIDUALS	P Value
20-30 YRS	448.2±48.6	472.2±56.4	<0.05	70.2	76.8	<0.05
31-40 YRS	463.5±28.4	498.6±34.6	<0.05	68.4	77.9	<0.05
41-50 YRS	482.6±44.5	492.2±28.5	<0.05	66.8	78.2	<0.05
51-60 YRS	476.8±12.4	480.6±38.4	<0.05	70.6	75.8	<0.05
> 60 YRS	436.4±52.2	464.4±36.2	<0.05	71.4	78.8	<0.05

Table-5: Pulmonary functions of cotton ginner with cotton dust exposure of 06 years (2005)

AGE GROUPS	FVC (l)	FEV1 (l)	FEV ₁ /FVC %	PEFR (l)
20-30 YRS	3.18±0.28	2.12±0.54	66.6	382.5+42.5
31-40 YRS	3.22±0.72	2.18±0.26	67.2	425.2+37.4
41-50 YRS	3.34±0.52	2.36±0.36	70.6	404.8+12.8
51-60 YRS	3.98±0.62	2.68±0.62	67.3	436.2+42.7
> 60 YRS	3.26±0.56	2.28±0.42	69.9	402.5+36.8

Table-6: Comparison of pulmonary functions of cotton ginner with cotton dust exposure of 06 years (i.e. from 1999 to 2005)

Age Groups	(PEFR l/min)			FEV ₁ /FVC %		
	1999	2005	P Value	1999	2005	P Value
	PEFR (L)	PEFR (L)		FEV ₁ /FVC %	FEV ₁ /FVC %	
20-30 YRS	448.2±48.6	382.5+42.5	<0.05	70.2	66.6	<0.05
31-40 YRS	463.5±28.4	425.2+37.4	<0.05	68.4	67.2	<0.05
41-50 YRS	482.6±44.5	404.8+12.8	<0.05	66.8	70.6	<0.05
51-60 YRS	476.8±12.4	436.2+42.7	<0.05	70.6	67.3	<0.05
> 60 YRS	436.4±52.2	422.5+36.8	N.S	71.4	69.9	N.S

DISCUSSION

A number of epidemiological studies have shown an increase in morbidity and pulmonary functions abnormalities in cotton workers, who have spent many years in cotton industries, demonstrating the presence of progressive respiratory abnormalities that may eventually become irreversible.²¹⁻²² Such diseases contribute to impairment in older and retired workers more commonly. It is quite fascinating that the present study shows a better status of pulmonary functions values in older age group of cotton ginner, specially in fifth and sixth decade of life and onward. It may be probably due to the personal protective measures adopted in the older age group keeping a wet cloth covering the nose and mouth while busy in cotton ginning.

There appears to be a positive relationship between the exposure to cotton dust and symptoms of cough, phlegm and dyspnoea and other atopic responses.²³⁻²⁴ In this study it was difficult to classify the workers complaining of cough and sputum from those suffering from chronic bronchitis, according to the medical research council's classification. However, independent of the effect of smoking, the evidence of noxious effects of cotton dust inhalation on the respiratory tract and its role in aetiology of cough and phlegm is obvious.

Despite progress in the description of the natural history of byssinosis, characterization of the functional abnormalities associated with the disease is limited.²⁵⁻²⁷ Byssinosis is a disease that affects workers employed in the cotton occupation. In its earliest stages, workers complain of chest tightness and shortness of breath. In the late stages, workers display irreversible pulmonary impairment. Pulmonary function changes in the chronic stage remain incompletely defined. We intend publishing our findings about the prevalence of chronic

respiratory symptoms in cotton workers in a subsequent paper.

It was not surprising that the majority of cotton ginner had an obstructive pattern of pulmonary function as they have been previously described' to have pathologic findings and symptoms of chronic bronchitis. By contrast, restrictive lung patterns have only been rarely associated with byssinosis. The findings of an excess of obstructive pattern in this study among cotton ginner raises the question about the underlying lung injury. It is possible that cotton ginner may develop pathologic changes that cause airway obstruction, such as chronic bronchitis in contrast to the findings of other relative studies which report interstitial fibrosis to be a main condition following a restrictive pattern of lung function due to the exposure of cotton dust.²⁸⁻³⁰

Though classical "Pinjara" type of cotton ginning is vanishing in the big cities of Pakistan and ginning factories are replacing this trade without any better scope and hope in the health care ground, chances of morbidity and mortality are equal, unless immediate effective attention is paid to develop firm protective measures. Teams of trained workmen, with all the basic medical knowledge about hygienic principles, have to be developed. Safety is much cheaper. Further, permanent losses of able workmen are a penalty to the whole nation. Rehabilitation facilities are 'obligatory to workers, which can save a great deal of financial asset.

In conclusion, our findings confirm and expand previous experiences with cotton workers studied prospectively and provide the base line data of pulmonary function tests in Pakistani cotton ginner. Thus we support the need to establish the relation between declines in pulmonary function in cotton ginner by carrying out a reliable longitudinal study, before critical decisions are made about the prevalence of pulmonary function related to cotton

dust exposure in Pakistan. However as suggested by Eugenija Zuskin and colleagues³¹, we believe that there is an urgent need for provision of rigorous air quality standards and medical surveillance in occupations, related to cotton exposure.

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Address For Correspondence

Dr. Saadat Ali Khan, Department of Physiology, Foundation University Medical College, Rawalpindi