Assessment of respiratory symptoms and lung function among textile workers at Kano Textile Mills, Kano, Nigeria

M Nagoda, JU Okpapi[1], M Babashani

Department of Medicine, Bayero University, Kano, [1]Medicine, Ahmadu Bello University, Zaria, Nigeria

Abstract

Background: The number of textile industries in Nigeria with large work force is on the rise. There is thus the need to assess medical challenges of its workers, one of which is respiratory ailments. Although much has been written about the subject globally, only few studies have been done in Nigeria. This study aims to address this gap.

Objective: A cross-sectional study was undertaken to determine the prevalence of respiratory symptoms and pulmonary functions among Textile Workers in Kano, Nigeria.

Materials and Methods: A cross sectional study was done, Two hundred male workers exposed to raw cotton dust and its end products in a Textile Company and 200 unexposed workers with similar age- and gender-matched were investigated. Their forced vital capacity (FVC), forced expiratory volume in one second (FEV11), and peak expiratory flow rate (PEFR) were determined with a flow-sensing spirometer and Wright's peak flow meter.

Results: Exposed workers generally complained of cough, phlegm production, rhinitis, wheezing, chest pain, and breathlessness. Unexposed worker has a significant lower frequency ($P < 0.001$) of symptoms as well as higher ($P < 0.001$) forced vital capacity (FVC), forced expiratory volume in one second (FEV11), and peak expiratory flow rate (PEFR) than exposed workers. The reduction in ventilatory function of exposed from predicted values for Nigerian men was significantly higher ($P < 0.001$) than unexposed workers. The smokers among the exposed and unexposed workers had significantly lower lung function values than nonsmokers.

Conclusion: Respiratory symptoms were more prevalent among workers in most dusty sections of the factory. Use of protective mask should be enforced. Workers in the spinning and weaving sections of the company compared with workers in other sections had the lowest lung function indices.

Key words: Lung functions, respiratory symptoms, textile workers

Date of Acceptance: 06-Apr-2011

Introduction

There are growing numbers of textile industries in Nigeria, creating the need for a system of protecting workers' health and ensuring their safety. Industrial production of textiles, occupational exposure to the raw materials, cotton dust, by-products and products of several chemicals, for example, dyes, had been associated with respiratory tract infections, broncoconstriction, cough, excessive mucus, nasal stuffiness, and nocturnal asthma.[1,2]

Textile workers are at increased risk of developing a spectrum of respiratory disorders,[3] upper respiratory tract infection, breathlessness, chronic obstructive airway disease, byssinosis, and asthma among others. These may spill over to the populace living in the environment of textile industries via air pollution.

Address for correspondence:
Dr. M. Nagoda,
Department of Medicine,
Bayero University, Kano, Nigeria.
E-mail: nagodamansur@yahoo.com

Access this article online	
Quick Response Code:	**Website**: www.njcponline.com
	DOI: 10.4103/1119-3077.104505
	PMID: 23238182

A lot of work has been done concerning textile workers mostly in Asia,[3] Europe,[4] and America but only scantly data is available for Africa, particularly Nigeria. Among the few, Oleru[5] described pulmonary impairment in Nigerian textile workers in 1987.

Due to paucity of published data relating to Nigerian textile workers, particularly in Kano State in which there are at present 5 functioning textile factories, employing a workforce of over 10,000 people, this study is justified.

The study assesses the spectrum of respiratory symptoms, spirometric assessment of lung functions of textile workers exposed to cotton dust.

Materials and Methods

A descriptive cross-sectional study was carried out to determine the pulmonary functions, pattern of ventilatory defects, and prevalence of respiratory symptoms among textile workers at Kano Textile Ltd.

Workers willing to participate were consented. Those with a minimum of 6 months exposure to cotton dust and ability to perform spirometric maneuvers of lung function testing were recruited. While those with features of lower respiratory tract infection and features of cardiac decompensation were excluded. Smokers were included in both exposed and controlled groups.

For the purpose of the study 400 workers at Kano Textile mills were recruited. Two hundred workers who were exposed to cotton dust for a minimum period of 6 months in printing, spinning, weaving, dying, and maintenance units were investigated. The study sample was selected from exposed population by stratified sampling technique because it is a heterogeneous population. Equal sampling ratio was allocated to each strata (proportional allocation) followed by simple random technique through balloting with each section represented in sample according to its proportion in the population.

The control group, that is, 200 workers were drawn from marketing and administrative units, respectively. These units are not near the production mill, hence are not exposed to inhaled cotton dust in the factory. Proportional allocation was taken from each stratum.

Total number of workers in exposed group = 2330

Sampling ratio = 200/2330 = 0.085

Population of each stratum, that is, printing, spinning, weaving, dyeing is 300, 1280, 430, and 3320 workers, respectively. Participants were therefore 26, 109, 36, and 28 workers. This was followed by simple balloting, making a total of 200 participants.

A similar criterion was applied in control group selection, that is, control group stratified into marketing and administrative units with population of 280 and 230 workers, respectively, using a sampling ratio 200/510 = 0.392, thus 280 × 0.392 = 110 workers 230 × 0.392 = 90 workers, respectively.

The subjects were interviewed using a self-administered questionnaire on respiratory symptom adopted from a modified Medical Research Council (MRC).[6]

Respiratory symptoms, cough ≥ 3 months, shortness of breath when walking, phlegm production, sneezing, and chest tightness were enquired.

Full physical examination, including blood pressure, weight, and height of each subject were taken.

Symptoms were designated as work related, if they improve on holidays or days away from work.

Eye and nasal irritation were considered as upper respiratory tract symptoms, whereas cough, phlegm, shortness of breath, wheeze, and chest tightness were considered as lower respiratory tract symptoms.

Symptom complexes compatible with chronic bronchitis and byssinosis were inquired. Byssinosis: Chest tightness or shortness of breath at work occurring in the first or other days of the work week according to criteria of Schilling and coworkers.[7]

Chest tightness at work: Tightness or constriction of the chest occurring any time during the work shift and on any workday, without being worse, especially on the first day of the working week.

Chronic bronchitis: Sputum production occurring on most (≥5) days of a week for at least 3 months a year for at least 2 consecutive years.

Chronic cough: Cough without sputum for ≥5 days a week for at least 2 consecutive years.

Dyspnea 2+: Having to walk slower than a person of the same age at an ordinary pace on level ground because of breathlessness.

FEV1er, shivering, malaises, joint weakness, and muscle pains were evaluated as organic dust syndrome.

A Wrights' peak flow meter was used to assess the PEFR after demonstrating the maneuver to each participant. This was then followed by spirometry using a computerized flow sensor, compact spirometer manufactured by Vitalograph Ltd England 2000.

Spirometric maneuvers were adequately explained and demonstrated to the subjects. Three satisfactory acceptable measurements of $FEV1_1$, for each subject were preformed in accordance with American Thoracic Society Standards.[4]

The highest of the 3 values of FVC and $FEV1_1$ were taken as representative values for each subject.

Values of PEFR expressed as percentage of predicted value for Nigerians using the formula derived from ventilatory studies in Nigeria were used.[8,9]

Information obtained was stored on a portable computer and analyzed using SSPS info.

The information obtained was analyzed with the help of a statistician. Results were expressed as means [standard deviation (SD)] and/or as median ranges; Chi-square tests was used to test the significance of association. Student's *t* tests were used for comparing the means of continuous variables of values < 0.05 were considered significant. Pearson's correlation was applied were necessary.

Limitations

Inability to estimate the dust/endotoxin level and humidity level due to lack of a device. Chest X-rays, sputa examination were not carried out due to financial limitations.

Results

Participation of workers in both the groups was 100%. Workers were grouped into 6 sections based on the nature of work. The distribution of men in various sections of the company was 26 (6.5%) in printing, 109 (27.3%) in spinning, 37 (9.3%) in dyeing, 28 (7.0%) in weaving, 110 (27.5%) in maintenance, and 90 (22.5%) in marketing.

The mean age for exposed and control groups were 36.9 ± 10.9 (age range, 18–55) years and 38.0 ± 9.6 (18–60) years. There was no significant difference in age between the 2 groups ($P > 0.05$). The age group with largest number of exposed workers was 30–34 years, while for the control group was 35–39 years.

The mean heights of the exposed and control groups were 165.5 cm (range, 148–168; SD, 9.6) and 170.3 cm (range, 155–188; SD 6.8), respectively. The mean weight of exposed and control groups were 67.9 kg (8.8) (range, 50–88; SD, 8.8) and 63.2 kg (range, 33–86; SD, 14.3), respectively.

The prevalence of smoking in exposed and control groups were 19.2% and 10%, respectively. The mean number of sticks smoked per day was similar in both the groups (15.2 ± 6.8 in exposed and 17 ± 5.2 in control).

Among the various sections of the company, workers in spinning section had the highest prevalence of cigarette smokers (21%), whereas workers in printing section had the least (13%). A total of 252 (63%) workers had respiratory symptoms [Tables 1 and 2]. A total of 148 (37%) were symptom free. Rhinitis was present in 237 workers (59.2%) and cough was present in 114 (28.5%) of the workers. These were the most prevalent respiratory symptoms. Allergy was the least prevalent in both the groups.

Cough was present in 86 exposed workers (43%) compared with 28 (14%) in the control group. Thirty-four workers with cough were in the spinning section, which was higher than in other sections.

Eighty-two workers (41%) in the exposed group produced phlegm, compared with 24 (23%) in the control group. A higher number of exposed workers producing phlegm were from the spinning section (40).

Table 1: Prevalence of respiratory symptoms in textile workers by nature of job

Nature of work	No. of workers (%)	No. with symptoms (%)	
Printers	26 (6.5)	26	
Spinners	109 (27.3)	95	
Dyeing	37 (9.3)	33	
Weavers	28 (7.0)	28	
Maintenance	110 (27.5)	35	
Marketers	90 (22.5)	35	
Total	400 (100)	252 sym (63)	Sym free 148 (37)

Table 2: Association between cotton dust exposed and respiratory

Symptom	Exposure n = 200	Control n = 200	Chi-square test	Odd ratio (95% Confidence interval)
Chest tightness	45	12	<0.05 (s)	4.55 (2.23>9.43)
Sputum	82	24	<0.05 (s)	5.10 (2.97>8.79)
Cough	86	28	<0.05 (s)	4.63 (2.77>7.78)
SOB + Wheeze	49	24	<0.05 (s)	2.38 (1.35-4.21)
Weakness	46	24	<0.05 (s)	2.19 (1.24-3.89)
Malaise	46	24	<0.05 (s)	2.19 (1.24-3.89)
Muscle pain	38	24	<0.05 (ns)	not significant
FEV1er/shivering	46	20	<0.05 (s)	2.69 (1.47-4.94)
Coryza running nose, sneezing, eye irritation	170	67	<0.05 (s)	3.90 (2.7.5.44)

None of the workers in both exposed and control group uses respiratory mask as a protective device during work shift. Breathlessness was present in 49 (24.5%) exposed workers compared with only 24 (12%) in the control group. Among those with breathlessness in the exposed group, printing and spinning section had 14 (19.2%) and 19 (26%), respectively. Chest tightness was present in 45 exposed workers (22.5%) compared with 12 in the control group (6.0%). Among those with chest tightness in the exposed group, spinning (21 workers) and printing (13 workers) had the highest numbers. When those with chest tightness were asked, specifically about Monday morning chest tightness, on resumption to work, 10 workers conceded to having it. Wheezing was present in 27 (13.5%) of exposed workers compared with 3 (1.5%) among control subjects. Rhinitis was the most prevalent symptom among exposed workers. One hundred and seventy workers (85%) in the exposed group had rhinitis compared with 67 (33%) workers in the control group. Of those in the exposed group with rhinitis, Spinning and Weaving sections had 85 (35.9%) and 28 (11.8%), respectively. Allergy was reported by only 2 (1%) and 3 (1.5%) workers in exposed and control groups, respectively.

Lung functions tests

The mean values of PEFR, FVC, and $FEV1_1$ of exposed group were lower than those of the control group, so also were the percentages of the predicted values [Tables 3 and 4]. The mean value for the percentage predicted for PEFR, FVC, and $FEV1_1$ were significantly lower for smokers than nonsmokers among the exposed group (P values < 0.001). Similarly, among the control group, the near values for PEFR, FVC, and $FEV1_1$, were significantly lower for smokers than nonsmokers (P values < 0.001, Table 3).

The $FEV1_1$/FVC was slightly higher for nonsmokers than smokers in the exposed group. The mean values of percentage predicted value of PEFR, FVC, and FEV1 for smokers in the exposed group were significantly lower than their corresponding value for smokers in the control group.

Lung function test and age

The mean value of $FEV1_1$, FVC, PEFR, and their percentage predicted values are shown in Figures 1 and 2,3. These indices increased with age up to 20–24 years and then steadily declined thereafter.

Lung function test and duration of exposure

The lung function test by duration of exposure is shown in Table 5. This showed no consistent variation in mean values of PEFR, FVC, $FEV1_1$, and $FEV1_1$/FVC ratio with duration of employment in the factory.

Effect of acute shift exposure on lung function test

The prework shift values of exposed workers who had complained of chest tightness and wheezing were measured. The mean value were PEFR, 527 ± 52; FVC, 3.381 ± 0.52; and $FEV1_1$, 2.68 ± 0.5. The postwork shift value were PEFR, 518 ± 53; FVC, 3.07 ± 0.52; and $FEV1_1$, 2.36 ± 0.51.

Table 3: Lung function tests compared with predicted values for age, gender, and height among smoking and nonsmoking workers

Lung function	n = 347 Non-smoking		n = 53 smokers		P < 0.001
$FEV1_1$ (L)	2.06	3.79	2.41	3.55	Significant
FVC (L)	3.2	3.04	3.09	2.97	Significant
PEFR (L/m)	550	521	478	545	Significant

FVC=Forced vital capacity; $FEV1_1$=forced expiratory volume in one second; PEFR, peak expiratory flow rate; The mean percentage predicted values of PEFR, FVC, and $FEV1_1$ for spinning and weaving were the lowest compared with other sections; Among those who reported wheezing (27; 13.5%) in the exposed group, only 5 (2.5%) had spirometric and clinical evidence of airway obstruction

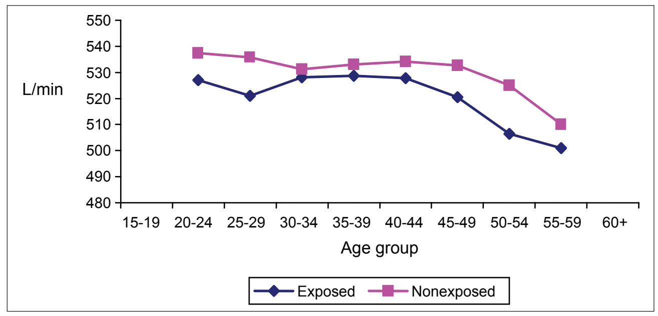

Figure 1: Peak expiratory flow by age group

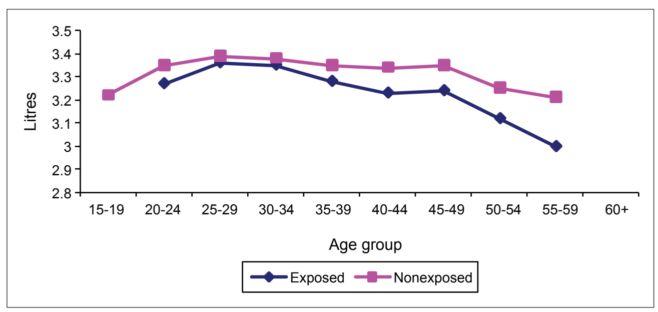

Figure 2: Forced vital capacity by age group

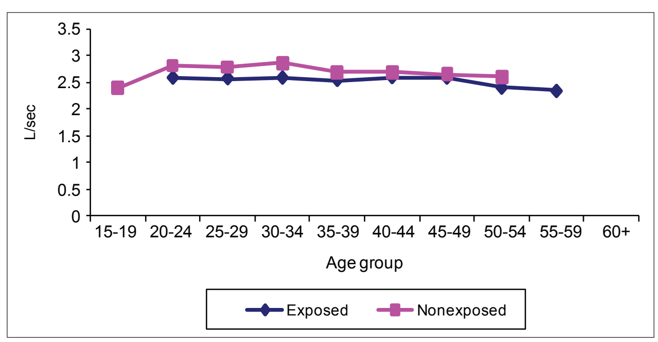

Figure 3: Forced expiratory volume in one second by age group

Table 4: Lung functions test compared with predicted values for age, gender, height by nature of work

Nature of Work	$FEV1_1$			FVC			PEFR			Ratio (%)
	Observed	Predicted (%)	*P* Value	Observed	Predicted (%)	*P* Value	Observed	Predicted	*P* Value	
Printers	2.60	86	0.0001 (s)	3.14	88	0.0001	532.3	90	<0.05	83
Spinners	2.44	80	0.0001 (s)	3.14	82	0.0001	508.5	84.4	<0.05	78
Dyers	2.66	86	0.0001 (s)	3.25	88	0.0001	511.9	86.2	<0.001	82
Weavers	2.40	80	0.0001 (s)	3.05	80	0.0001	506.5	80.2	<0.001	79
Maintenance	2.75	86	0.0001 (s)	3.24	86	0.0001	520	92	<0.05	85
Marketers	2.79	86	0.0001 (s)	3.25	86	0.001	525	95	<0.05	86

FVC=Forced vital capacity; $FEV1_1$=Forced expiratory volume in one second; PEFR=Peak expiratory flow rate

The difference between the mean values for pre- and postshift measurements was statistically significant for FVC and $FEV1_1$ ($P < 0.05$), whereas not for PEFR ($P > 0.05$).

Based on the $FEV1_1$/FVC ratio, less than 80% of the predicted value for exposed and control groups, obstructive pattern was found in 20 (10%) and 11 (5.5%) of exposed and control workers, respectively. Restrictive pattern based on FVC less than 80% of predicted value, with a normal $FEV1_1$/FVC was found in 80 (40%) workers in the exposed group and 10 (5%) in the control group. The mean value of PEFR (550 ± 51 L/min) for the control group in the present study was similar to PEFR reported by Anyawu *et al*. (546.88 L/min) and Ahuja *et al.*[10] The mean value reported by Ali (483.3 L/min)[11] was lower than the above values. However, all the mean values of PEFR quoted above were lower in Nigerians compared with Caucasian males of the same weight, height, and age using the formula by Leiner *et al.*[12]

The mean values of FVC (3.2 ± 0.24 L) from this study was lower compared with FVC reported by Femi-Pearse *et al.*,[13] with similar values of 3.24 reported by Onadeko *et al.*[14]

The mean values for FVC and $FEV1_1$ for Nigerian men from all studies were lower than predicted value using formula by Kory *et al*.,[6] as well as formula suggested by manufactures of the spirometer in Caucasians, which gives between 15% and 20% higher values.

Discussion

The prevalence of respiratory symptoms was higher in exposed group than in the control group in this study (63% vs 35%), probably due to inhalation of cotton dust in textile factory. Oleru,[5] in a similar study, reported the prevalence of respiratory symptoms in the exposed group to be higher than in the control group in Nigeria (38%) with cough and phlegm as the most common symptoms. In a recent study in Asaba, Nigeria,[15] spinners had the highest prevalence of respiratory symptoms (11.5%). The prevalence rates from Nigerian studies are lower than that of the prevalence observed by Simpson *et al*. This report revealed a prevalence of 45.1% for upper respiratory tract symptoms and 38.1% for lower respiratory tract symptoms. The prevalence rates from Nigerian studies are possibly lower, due to relatively lower level of industrial pollution and different manufacturing technology. The provision of better personal protection facilities may explain the low figure observed for the United Kingdom. Furthermore, the difference in genetic susceptibility, atopic predisposition, and sensitization levels to various substances may contribute to this variation.

Table 5: Mean values of $FEV1_1$ and FVC compared with predicted values for age, gender, and height by duration of work

Duration of work (years)	O FEV_{11}	P FEV_{11}	*P* value	O FVC	P FVC	*P* value
0–1	2.60	3.9	0.0001	3.16	3.25	0.095 (NS)
2–5	2.69	3.74	0.0001	3.34	3.05	0.0001 (S)
6–10	2.52	3.61	0.0001	3.16	2.96	0.68 (NS)

FVC,=Forced vital capacity; $FEV1_1$,=Forced expiratory volume in one second; O,=Observed; P,=Predicted; NS,=Not significant; S,=Significant; Linear regression coefficient showed no strong correlation between changes in $FEV1_1$ and number of sticks smoked in exposed/control groups

The prevalence of cough, phlegm production, breathlessness, and wheezing decreased after 5 years of employment, thereafter rising with increased duration. The prevalence of chest tightness and rhinitis, however, decreased with duration of employment. Cough and rhinitis were the most prevalent symptoms in this study. This might partly be explained by the effect of the dry, dusty, cold, and windy Harmattan season during which this study was carried out.

The prevalence of respiratory symptoms varied among various sections of the company, with the spinning section having the highest frequency of symptoms, followed by weaving and printing, respectively. This compares well with the report by Osibogum *et al*.,[15] which revealed a higher prevalence of respiratory symptoms among spinners compared to workers in other sections of Asaba Textiles.

The higher prevalence in the spinning and weaving sections was probably because these sections were dustier than the remaining sections of the company. A history of allergy was present in only 5 workers, 2 of whom were in the printing section and 3 among the control group. The 2 workers in the printing section did not recognize the association of their allergies with any substance encountered in the company.

Wheezing was reported by 27 (13.5%) of the exposed workers, but only 3 (1.5%) among the control group. Nine (4.5%) of those with wheezing had PEFR and $FEV1_1$ lower than the predicted value. The clinical findings in these 9 subjects suggested the possibility of obstructive airway disease.

Among the 45 workers with chest tightness in the exposed group (24%), only 10 had spirometric and clinical evidence of airway obstruction. This suggests that objective evidence of airway obstruction is common among exposed workers who reported wheezing and chest tightness. More than half of smokers (52.3%) in the exposed group had cough, and about a third (28%) had phlegm. Most of these workers were in the dustiest sections of the factory. The odds ratio for cough and phlegm production showed a significant association with cigarette smoking among the exposed workers.

Lung function tests

In the present study, the mean FEV1, FVC, and PEFR were significantly lower for the exposed group than the control group. So also were their percentage predicted values. The predicted values in the exposed group in the present study were higher than in Oleru's reported average (82% vs 60%).[5] This was also observed in the control group. The difference may be attributable to different types of spirometers used in the 2 studies. Automated spirometers used in this study may have greater accuracy, than vitalograph used by Oleru. This is supported by a report of Anyawu *et al*., which recorded higher lung function indices with electronic spirometer in healthy young Nigerians compared with earlier reports of similar studies done in Nigeria.

The mean values of FVC and FEV1 for the control group in this study were, however, lower than those reported by Ahuja *et al*.[10] (FVC, 3.20 vs 3.80; FEV1, 2.60 vs 3.30). This might be because Ahuja *et al*.'s study included smokers and a younger age group than the present study (mean of 38.0 ± 9.6 vs 24.3 ± 7.9 years).

There was a significant difference between the mean percentages in the predicted value of PEFR, FVC, and FEV1 of nonsmokers and smokers in the exposed and control groups [Table 5]. Similarly, in Oleru's report, smokers had lower lung function indices. The lower lung function indices in cigarette smokers and occupational substance exposure have been supported by various studies.[16]

The $FEV1_1$ of exposed and control groups were almost the same, probably reflecting a low incidence of obstructive airway disease among the exposed group. Spirometry showed an obstructive pattern in 20 (10%) of the exposed workers compared with 11 (5.5%) among the control group. The restrictive pattern was seen in 80 (40%) of the exposed workers with only 10 (5%) in the control group.

The mean percentage predicted value for $FEV1_1$ and FVC was lowest in the spinning section, with the highest value observed in the maintenance and marketing sections, possibly due to reduced exposure.

Byssinosis was seen in 10 (5%) exposed workers, all in the spinning section with none in the control group. These findings were consistent with recent results showing a low prevalence of byssinosis in Nigeria.[15]

Conclusion

The prevalence of respiratory symptoms among workers exposed to cotton dust in the textile company studied was 63%, with rhinitis 59%, cough 28.5%, and breathlessness 24% occurring as the most common symptoms.

The study showed a strong association between substances inhaled in the factory environment (cotton dust) and frequency of respiratory symptoms, probably in a dose– response relationship because of the frequent occurrence of respiratory symptoms among workers in the dustiest sections of the company.

Exposure to cotton dust encountered in the factory environment was shown to reduce PEFR, FVC, and $FEV1_1$ in the workers. Cigarette smoking was demonstrated to have a negative influence on lung function indices of unexposed workers. This is supported by reports from various studies, which showed synergistic effect of smoking with occupational dust in causing respiratory symptoms.

The study revealed an obstructive pattern in 20 (10%) exposed workers on spirometry and a restrictive pattern in 80 (40%) exposed workers. The duration of exposure was shown to have no significant correlation with lung function measurement among the exposed workers.

Preventive measures are of paramount importance in minimizing the prevalence of respiratory disorders in cotton textile workers. This includes measures aimed at the improvement of working conditions, pre-employment and periodic medical examination of workers. Based on this study the following are recommended:

Enforcing the use of personal protective equipment, such as respirators and face masks, especially in weaving and spinning sections. Avoiding continuous exposure to cotton dusts without weekend interruptions and rotation of work force through various sections.

Cotton dust concentration in the factory should be monitored with strict adherence to permissible exposure limits on day-to-day basis in various sections to prevent cotton dust disease in exposed population. This could only be achieved by vertical elutriator sampler with results exposed as milligrams of airborne particulate (cotton dust) per cubic meter.

Finally, a factory clinic should be in place. This will ensure good occupational health practice and periodic medical evaluation of workers.

Acknowledgment

My sincere gratitude goes to Prof. J U Okpapi and Dr. M Borodo for their guidance and encouragement.

References

1. Newman LS. Occupational illness. N Engl J Med 1995;333:1128-34.
2. Brewis RA. Practical pulmonary function tests. Practitioner 1977;219:681-91.
3. Christiani DC, Wang XR. Longitudinal changes in pulmonary function and respiratory symptoms in cotton textile workers. Am J Respir Crit Care Med 2001;163:591-604.
4. Simpson JC, Niven RM, Pickering CA, Fletcher AM, Oldham LA, Francis HM. Prevalence and predictors of work related respiratory symptoms in workers exposed to organic dusts. Occup Environ Med 1998;55:668-72.
5. Oyejide OC; Sample size determination in Oyejide OC ed Health research methods for developing country scientists. Ibadan Codat Publications, 1989:56-7.
6. Kory RC, Callahan R, Boren HG, Syner JC. The Veterans Administration-Army cooperative study of pulmonary function. I. Clinical spirometry in normal men. Am J Med 1961:30:243-58.
7. Laszlo G. Assessing lung function. Br J Hosp Med 1991;46:311-22.
8. Beckett WS, Pope CU, Christian DC. Women's respiratory health in cotton textile industry. An analysis of respiratory symptoms in 973 non-smoking female workers. Occup Environ Med 1994;51:14-8.
9. Chaing ST. Han TS. Peak flow rate in relation to age, sex and anthropometric measurements. Acta Paediatr Scand 1965;54:439-44.
10. Ahuja GK, Ahuja IS. A comparative study of ventilatory pulmonary function tests in health and disease in Nigerian males. West Afr Med J 1983;2:61-5.
11. Ali MA. Ventilatory functions in non-smoking healthy Nigerian adults. West Afr J Med 1983;2:1-8.
12. Leiner GC, Abramowitz S, Small MJ, Stenby VB, Lewis WA. Expiratory peak flow rate. Standard values for normal subjects. Use as a clinical test of ventilatory function. Am Rev Respir Dis 1963;88:644-51.
13. Femi-Pearse D, Elebute EA. Ventilatory function in healthy adult Nigerians. Clin Sci 1971;41:203-11.
14. Onadeko BO, Falase AO, Ayeni O. Pulmonary function studies in Nigerian sportsmen. Afr J Med Sci 1976;5:291-5.
15. Osibogun A, Osji MI, Isah EC. Prevalence of Byssinosis and other respiratory problems among textile workers in Asaba Nigeria. Niger Postgrad Med J 2006;13:333-8.
16. Dosman JA. Occupational exposure to cigarette smoking. Respiratory health protection in the workplace. J Public Health Policy 1985;6:185-96.

How to cite this article: Nagoda M, Okpapi JU, Babashani M. Assessment of respiratory symptoms and lung function among textile workers at Kano Textile Mills, Kano, Nigeria. Niger J Clin Pract 2012;15:373-9.

Source of Support: We wish to aknowlegede the support of Department of physiology Bayero University and department of Medicine Aminu Kano Teaching Hospital for providing the spzirometer and technical assistance for this study, **Conflict of Interest:** The authors of this study have no vested interest in the textile industries mentioned in the study and have no working relationship with the manufacturers of the spirometer machine used for the study.