Original Article

Respiratory and other illnesses among the jute-mill workers in an industrial unit of Bangladesh

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Abstract

Background and aims: Bangladesh produces 33% of the world's jute and about 40 million people in Bangladesh are directly or indirectly involved in the jute sector. The jute (organic) dust inhalation causes byssinosis and other respiratory illnesses. However, no study has yet addressed the health status of the jute handlers/workers in Bangladesh.

This study aimed to determine the prevalence of respiratory illnesses among the Jute Mill Workers (JMWs). Additionally, this study tried to find out the overall health status of the JMWs which included presence of non-communicable diseases (NCD) and its related risk, which are usually ignored.

Study design: A cross-sectional study conducted in a purposively selected jute mill - 40km off from Dhaka City. Of the 5500 workers, a list of 600 workers was provided by the mill authority for enrollment in the study. The investigations included – a) interviewing on socio-demography and clinical history; b) anthropometry (height, weight, waist- and hip-circumference); c) blood pressure measurement; d) estimation of fasting blood glucose and lipids; e) peak flow meter test; f) spirometry; g) high resolution computerized tomography (HRCT) and electrocardiography.

Results: Of the enlisted 600 jute mill workers, 514 (men / women = 478 / 36) took part in the study. The response rate was 85%. For overall estimate of bio-physical characteristics (n = 514), the means (95% confidence interval) of age, body mass index (BMI), waist-hip ratio (WHR), systolic blood pressure (SBP) and diastolic blood pressure (DBP) were 44.19 (43.34 – 45.04) years, 24.44 (24.16 – 24.73), 0.90 (0.90 – 0.91), 118.9 (117.4 – 120.4), 79.69 (78.81 – 8/0.54), respectively.

Regarding social class and education, 84.4% were from non-affluent (poor) class and 50% were illiterate. About 88% of the JMWs had been working for ≥42 hours a week and 91.6% were exposed to moderate or heavy work (equivalent to ≥60 min walk).

The prevalence of breathlessness, tightness of chest and chronic cough were 16.5%, 25.7% and 16.3%, respectively. The restrictive and obstructive pulmonary functions were detected in 7.0% and 0.8% of study population respectively. The prevalence of systolic hypertension was 16.5%, diastolic hypertension was 7.2% and diabetes (IFG+DM) was 13.3%. They had increased cardiovascular risks – hypertriglyceridemia (23.9%) and hypercholesterolemia (24.3%).

Conclusions: JMWs have been suffering mostly from respiratory illnesses and a substantial number of them suffer from undiagnosed hypertension, diabetes and other non-communicable diseases. Dyslipidemia was also prevalent as a potential risk factor. The study could not assess ocular, auditory, musculoskeletal and mental health and it suggests that a well designed study should address these health related problems of JMWs.

IMC J Med Sci 2019; 13(1): 007. DOI: https://doi.org/10.3329/imcjms.v13i1.42040

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Introduction

Byssinosis is a specific disease of respiratory organ caused mostly by an occupational exposure to organic dust from jute, cotton, hemp or flax [1]. These organic dusts are involved in pathogenesis of obstructing the small air tubes of the lungs. It may also cause permanent lung damage similar to chronic obstructive lung disease. It was reported that 22.8% workers in jute industry suffer from byssinosis-like illness [2]. In addition, the study showed acute and chronic changes of pulmonary function in 25.7% and 20.0% of workers respectively. Similar studies observed some acute and chronic changes of ventilatory function in 35.7% and 31.6% of workers, respectively [3, 4]. Thus, it appears that about one-fifth to one-fourth of the workers is at risk of byssinosis or similar pulmonary disorders.

Bangladesh is one of the largest jute producing country. More than 1.5 million workers are employed in 11,983 presently functioning looms of jute industries in Bangladesh [5]. It is estimated that 307 jute mills (government /non-government = 26 /281) have been producing jute goods. The jute products are exported to India, Syria, Tunisia, Turkey, Iraq, Thailand and other countries. The daily average wage of jute-mill workers (JMW) has been reported as BDT ~308.00 (approximately USD 3.6) [5]. The health status of the low paid JMW remained unknown. In Bangladesh, no study has been so far conducted to assess their health problems. The common occupational health problems of the JMWs as mentioned earlier [2,3], are byssinosis like illness with symptoms of cough, chest tightness and breathlessness and other respiratory diseases due to organic dust inhalation. The other non-communicable diseases (NCD) like diabetes, hypertension, coronary heart diseases, though prevalent among them, are usually ignored. Therefore, this study has been designed to determine the prevalence of the above mentioned disorders, and to detect hitherto ignored diseases and the risk factors related to those diseases.

Study design

This study protocol was approved by the Institutional Review Board of Ibrahim Medical College.

***Selection of Jute mill and participants*:** We purposively selected "Latif-Bawany Jute Mill". This mill has been functioning with full capacity for decades. It is situated at Demra about 45 km off Dhaka City by the side of a river, Shitalaksma.

The jute mill authority was contacted from Ibrahim Medical College. The investigators from the Medical College discussed regarding the objectives and procedural steps of the study in detail with the mill authority. Workers working in the mill for at least 5 years were enrolled in the study. Six hundred participants were selected from a total of 5500 JMWs. The selection was randomized from every morning shift so that the looms remain functioning without interruption. Verbal consent was taken from each participant. A semi-structured questionnaire was used for data collection. Each participant was interviewed regarding - i) personal history (age, education, social class, family income, employment, type and duration of dust exposure, smoking) and ii) clinical history (past and present illness, medication, family history of obstructive lung disease, diabetes, stroke, hypertension and coronary artery disease).

***Anthropometry*:** Several anthropometric measurements namely height, weight, waist and hip circumference were taken to assess the general and central obesity status. Body mass index (BMI) was calculated using weight in kilogram divided by height in meter and expressed as kg/m^2. Waist-to-hip ratio (WHR) and waist-to-height ratio (WHtR) were calculated as waist measurement divided by hip or height measurement respectively. BMI was used for determining the general obesity while the latter two (WHR, WHtR) indicated central obesity. Blood pressure of each participant was measured after ensuring at least ten minutes of rest in a complete relaxed environment. The means of two readings were accepted.

***Collection of blood and biochemical tests*:** Five milliliter of fasting blood sample was collected taking every aseptic measure from anti-cubital vein. The collected venous blood samples were transported to Ibrahim Medical College for estimation of fasting blood glucose (FBG), lipids (total Cholesterol [t-Chol], triglycerides [Tg], high density lipoprotein [HDL] and low-density lipoprotein [LDL]).

***Peak flow meter test*:** Each participant was discussed and demonstrated repeatedly about peak flow meter test. We used "Tables of Normal Peak Flow Values", based on age, sex and height provided by

"GUIDE TO ASTHMA" of Asthma Center, Partners Health Care. The mean of three values (liter per min) were considered for interpretation.

***Spirometry*:** It was undertaken for those who had complaints of breathing difficulty at rest, persisting cough for >3 months and feeling of chest tightness. The values were adjusted taking age, height, sex and ethnicity. The cases having abnormal values (FEV1/FVC <70% or >85%) were referred to the Department of Pulmonology, Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine Metabolic Disorders (BIRDEM). Spirometry instruments kept adjusted with South Indian ethnicity [6].

High resolution computer tomography scanning (HRCT) of lungs: The participants having restrictive or obstructive lung diseases (based on spirometry) were referred to BIRDEM hospital for HRCT and recheck spirometry as well.

***Electrocardiogram (ECG*):** ECG was advised for those who had family history (first degree) of heart attack (sudden death), diabetes, hypertension and / or stroke. ECG was also done to those who were found hyperglycemic (FBG =>5.9 mmol/l), and hypertensive (SBP =>140 or DBP =>90mmHg).

***Definitions of obstructive and restrictive lung function*:** The best values of lower limit [LLN] and upper limit [ULN] of normal based on age, sex and ethnicity, using all loops, were obtained by Spirometry. If the predicted (%) values of forced vital capacity (FVC) and forced expiratory volume in one second (FEV1) were found within this limit then it was accepted as normal. Obstructive disease was diagnosed if FEV1/FVC was <70% and if the value exceeded 85% then it was diagnosed as restrictive lung disease [6-8].

***Statistical analyses*:** The biophysical characteristics were given in means with standard deviations. Unpaired student's t-test compared the characteristic variables between men and women. Chi-Sq estimated the associations between sex and diseases. Correlation coefficient 'r' assessed the associations between values of peak flow meter with that of spirometry.

Results

Of the enlisted 600 jute mill workers (JMW), 514 (men / women = 478 / 36) finally participated in the study. The response rate was 85%. The bio-physical characteristics of the total study population (n=514)

Table-1: *Characteristics of jute-mill workers (all participants, n = 514) and comparison between male (n=478) and female (n = 36).*

Variables	All		Male		Female		*p*
	mean	¥95%CI	Mean	SD	Mean	SD	
Age (y)	44.19	43.34 – 45.04	44.3	9.8	*42.8*	*9.3*	*.388*
Height (cm)	161.82	161.3 – 162.4	162.5	6.4	150.3	5.9	*.000*
Weight (kg)	64.10	63.24 – 64.97	64.7	9.8	56.2	8.4	*.000*
Waist (cm)	82.61	81.85 – 83.37	82.6	8.0	86.1	9.9	*.015*
Hip (cm)	91.23	90.58 – 91.87	90.9	7.3	94.9	9.7	*.003*
SBP (mmHg)	118.96	117.4 – 120.4	118.9	16.8	120.1	22.6	*.696*
DBP (mmHg)	79.68	78.81 – 80.54	79.8	9.9	78.0	10.8	*.324*
BMI (kg/m^2)	24.44	24.16 – 24.73	24.4	3.24	24.9	3.54	*.427*
Waist-to-hip ratio	0.904	0.90 – 0.91	0.907	0.044	0.906	0.035	*.888*
Waist-to-height ratio	0.512	0.508 – 0.517	0.508	0.048	0.573	0.066	*.000*
FBG (mmol/l)	5.69	5.51 – 5.87	5.71	2.16	5.45	1.70	*.490*
TG (mg/dL)	168.6	160.8 – 176.5	170.1	88.8	152.8	78.5	*.269*
TC (mg/dL)	157.43	153.1 – 161.7	158.6	49.8	141.1	32.7	*.045*
HDL (mg/dL)	45.92	44.9 – 46.9	45.9	11.4	46.1	9.9	*.916*
LDL (mg/dL)	77.64	73.64 – 81.56	76.81	45.9	64.46	28.4	*.122*
PEF (ml/sec)	450	442 – 459	464	99	310	93	*.000*

¥ - 95% confidence interval after one sample t-test; p value by student's t test; SBP= Systolic blood pressure; DBP= Diastolic blood pressure; BMI= Body mass index; FBG= Fasting blood glucose; TG=Triglycerides; TC= Total cholesterol; HDL= High density lipoprotein; LDL= Low density lipoprotein; PEF= Peak expiratory flow.

Table-2: *Socio-demographic characteristics of participants (n = 514)*

Characteristics	N (%)
Sex	
Male	478 (92.9)
Female	36 (7.1)
Social class	
Non-affluent / poor	433 (84.4)
Middle class	48 (9.4)
Affluent	32 (6.2)
Education	
Illiterate	258 (50.5)
Read and write (no academic education)	139 (27.2)
Secondary (SSC /HSC)	69 (13.5)
Graduate (and plus)	47 (9.2)
Marital status	
Married	488 (95.5)
Household members (mean ±SD)	5.04 ±1.63
Duration of work per week	
≥42 hours	452 (88.1)
<42 hours	61 (11.8)
Duration of service (mean ±SD) year	21.8±10.1
Smoking habit (cigarette or biri)	
Never smoked	339 (66.0)
Passed smoker (smoker ≥6m back)	62 (12.1)
Regular smoker (≥6 sticks/day)	112 (21.8)
Habit of tobacco or Jarda with beetle and/or nut?	
No	349 (68.0)
Yes	164 (32.0)
Physical activity	
Sedentary	14 (2.7)
Mild (equivalent to <60min walk)	29 (5.7)
Moderate to heavy (≥60 min walk)	470 (91.6)

Note: SSC- Secondary School Certificate, HSC- Higher Secondary Certificate.

are expressed in means with 95% confidence interval (Table-1). The means with 95% CI of age, BMI, WHR, SBP and DBP were 44.19 (43.34 – 45.04) years, 24.44 (24.16 – 24.73), 0.90 (0.90 – 0.91), 118.9 (117.4 – 120.4), 79.69 (78.81 – 8/0.54), respectively. The comparisons of bio-physical characteristics (mean with SDs) between men and women were also shown in the same Table. Some anthropometric measures differed significantly. The peak flow value was found significantly higher in men than women.

Socio-demographic variables of the participants are depicted in Table-2. The JMWs were predominantly men (92.9%). Regarding social class, 84.4% were from non-affluent (poor) and 50% were illiterate. About 88% of the JMWs have been working ≥42 hours a week and 91.6% were exposed to moderate or heavy work (equivalent to ≥60 min walk).

The interviewing session (clinical history and medical records) revealed that 14.6%JMWs had diagnosed diseases and 85.4% were (apparently) healthy (Table-3). These findings indicate that some non-communicable diseases (NCDs) were prevalent at any given time. The most common ailment, as revealed from history and medical records, was hypertension (HTN, 5.2%) and other common illnesses were diabetes mellitus (DM, 4.5%)) and HTN plus DM (3.5%). For respiratory illness, only two (0.4%) had bronchial asthma.

Table-3: *Prevalence of illnesses among the jute mill workers (n = 514) based on clinical history, medication and medical records.*

Diseases	N (%)
Apparently healthy	439 (85.4)
Asthma	2 (0.4)
Coronary artery bypass in 2010	1 (0.2)
Diabetes Mellitus	23 (4.5)
Hypertension	27 (5.3)
Hypertension plus coronary heart disease (CHD)	1 (0.2)
Hypertension plus DM	18 (3.5)
Proteinuria (?Nephropathy)	1 (0.2)
Stroke	2 (0.4)
Total	514 (100)

? Strip-test indicated proteinuria (2+) but diagnosis could not be made

Based on the study investigations, the prevalence of respiratory, cardiovascular, urinary and metabolic illnesses of 514 JMWs are shown in Table-4. The comparison between men and women is also shown. The subjective complaints like breathlessness, tightness of chest and chronic cough (≥6wks) were 16.5%, 25.7% and 16.3%, respectively. Breathlessness was found significantly higher in men than women (16.7% vs. 13.9%, p=0.001). Hypercholesterolemia was also significantly higher in men than in women (25.3% vs. 11.12%, p = 0.045). In contrast, restrictive pulmonary disorders were significantly more among women than that of men (30.6% vs. 5.23%, p = 0.004).

The prevalence of systolic hypertension was 16.5% and diastolic hypertension was 7.2% and there was no significant difference between men and women. Known hypertension was 5.3% (Table-3), if compared with Table-4 then it would be clear that many of them had undetected hypertension. Likewise, diabetes also remained undetected (4.5% in Table-3, 11.9% in Table-4). As regards proteinuria the findings were similar ((0.2% vs. 3.1%). Only three participants (0.58%) had coronary heart disease. Interestingly, almost 1/4th of the study population had hypertriglyceridemia (23.9%) and hypercholesterolemia (24.3%). These findings indicate that these jute mill workers carry increased cardiovascular risks.

Table-5 depicted how *peak flow* values correlated with the values of spirometry. Correlation coefficient 'r' assessed how much significant were the correlations of peak flow values (n=514) with that of spirometry values obtained from participants randomly selected (n=67) for spirometry test.

Most of the spirometry values correlated significantly with the values of peak flow indicating the importance of peak flow meter test. The spirometry values were used to detect restrictive and obstructive respiratory

Table-4: *The prevalence of illnesses among the jute mill workers (n = 514; Male / Female = 478 / 36) identified following study investigations*

Diseases	All N (%)	Men N (%)	Women N (%)	*P**
Respiratory system				
Breathlessness	85 (16.5)	80 (16.7)	5 (13.9)	*0.001*
Tightness of chest	132 (25.7)	122 (25.5)	10 (27.7)	*ns*
Persistent cough (≥ 6wks)	84 (16.3)	78 (16.3)	6 (16.7)	*ns*
Restrictive (FEV1/FVC is >85% of predictive)	36 (7.0)	25 (5.23%)	11 (30.6)	*0.004*
Obstructive (FEV1/FVC is <70% of predictive)	4 (0.8)	3 (0.63)	1 (2.78)	*ns*
Cardiovascular system				
Systolic hypertension	85 (16.5)	76 (15.9)	9 (27.3)	*ns*
Diastolic hypertension	37 (7.2)	34 (7.1)	3 (8.3)	*ns*
Coronary heart disease (CHD)	3 (0.58)	2 (0.42)	1 (2.8)	*ns*
Urinary system				
Proteinuria (macro-proteinuria >2+)	16 (3.1)	16 (3.5)	none	-
Metabolic function, hyperglycemia				
IFG (FBG, 6.0 – 6.9mmol/L)	7 (1.36)	4 (0.84)	3 (8.33)	*ns*
DM (FBG ≥7.0 mmol/L)	61 (11.9)	58 (12.1)	3 (8.3)	*ns*
Metabolic function, lipids				
Hypertriglyceridemia ($\geq 75^{th}$ percentile, >207mg/dl)	123 (23.9)	114 (23.8)	9 (26.5)	*ns*
Hypercholesterolemia ($\geq 75^{th}$ percentile, >180mg/dl)	125 (24.3)	121 (25.3)	4 (11.12)	*0.046*

* - *p* after chi-sq. test; IFG= Impaired fasting glucose.

Table-5: *Correlations between peak flow (liter/second) with values of spirometry*

		FVC	FEV1	FEV1/FVC	PEF	FEF25-75%	FEF25%	FEF50%	FEF75%
Peak flow	*r*	.392**	.465**	.208	.625**	.391**	.432**	.407**	.214
	p	.001	.000	.099	.000	.001	.000	.001	.089
	n	64	64	64	64	64	64	64	64
FVC	*r*		.932**	-.039	.687**	.496**	.570**	.544**	.464**
	p		.000	.759	.000	.000	.000	.000	.000
	n		65	65	65	65	65	65	65
FEV1	*r*			.306*	.801**	.722**	.750**	.745**	.673**
	p			.013	.000	.000	.000	.000	.000
	n			65	65	65	65	65	65
FEV1/FVC	*r*				.343**	.627**	.539**	.585**	.601**
	p				.005	.000	.000	.000	.000
	n				65	65	65	65	65
PEFR	*r*					.711**	.846**	.682**	.619**
	p					.000	.000	.000	.000
	n					65	65	65	65
FEF25-75%	*r*						.864**	.952**	.885**
	p						.000	.000	.000
	n						65	65	65
FEF25%	*r*							.823**	.755**
	p)							.000	.000
	n							65	65
FEF50%	*r*								.823**
	p								.000
	n								65

Notes: p ** correlation is significant at the 0.01 level (2-tailed); * - correlation is significant at the 0.05 level (2-tailed). Peak flow – the means of three values (liter per min) were taken. FVC – Forced Vital Capacity; FEV1 – Forced Expiratory Volume in One Second; FEV1/FVC Ratio – total amount of air exhaled from the lungs during the first second of forced exhalation; PEFR – Peak Expiratory Flow Rate; FEF – Forced Expiratory Flow; FEF25%-75%: total amount of air exhaled from the lungs during the middle half of the forced vital capacity test; FEF25%: amount of air forcibly exhaled from the lungs in the first 25 percent of the total forced vital capacity; FEF50% - amount of air expelled from the lungs during the first half (50%) of the forced vital capacity.

Table-6: *Comparison of spirometry findings between participants having normal and restrictive lung functions (normal and restriction: FEV1/FVC <85% and ≥85% of the predictive)*

	Normal (n=31) FEV1/FVC <85%		Restrictive (n=35) FEV1/FVC ≥85%		p
	Mean	SD	Mean	SD	
Peak-flow	362.1	99.7	290.0	69.4	.001
FVC	74.8	14.6	46.0	9.9	.000
FEV1	77.5	17.1	48.9	12.8	.000
FEV1/FVC	109.6	12.7	111.6	14.7	.561
PEFR	78.7	23.4	52.1	18.1	.000
FEF25% –75%	68.8	29.5	50.8	26.1	.010
FEF25%	67.3	27.6	46.0	19.4	.000
FEF50%	68.8	29.0	47.0	25.6	.002
FEF75%	78.2	40.2	64.5	38.1	.160

Notes as shown under Table-5; Peak flow – The means of three values (liter per min) were taken; FEF75% - amount of air expelled from the lungs in the first 75% of the total forced vital capacity; p value by student's t-test.

Table-7: *Comparison of spirometry findings between participants having normal and obstructive respiratory abnormalities (normal and obstruction: FEV1/FVC ≥ 70% and < 70% of the predictive)*

	Normal (n=7) FEV1/FVC ≥70%		Obstruction (n=4) FEV1/FVC <75%		p
	Mean	SD	Mean	SD	
Peak-flow	385.7	98.8	250.0	70.7	.040
FVC	97.0	12.7	52.5	11.5	.000
FEV1	98.8	17.4	38.7	8.0	.000
FEV1/FVC	108.2	9.9	80.0	25.1	.024
PEF	91.0	27.7	35.0	3.7	.003
FEF25% –75%	80.1	27.9	22.7	17.6	.005
FEF25%	75.7	34.0	22.2	12.5	.016
FEF50%	79.4	30.0	25.5	25.0	.015
FEF75%	103.8	56.5	37.7	24.2	.057

Notes as shown under Table-5. p value by student's t-test; Peak flow – The means of three values (liter per min) were taken. FEF75% - amount of air expelled from the lungs in the first 75% of the forced vital capacity; p value by student's t-test.

Table-8: *Detail descriptive statistics of spirometry (n = 67)*

		FVC	FEV1	FEV1/FVC	PEF	FEF25%–75%	FEF25%	FEF50%	FEF75%
Mean		59.33	62.16	110.75	64.48	59.15	55.93	57.13	70.90
SD		18.9	20.6	13.8	24.5	29.0	25.7	29.1	39.4
SEM		2.3	2.5	1.6	3.0	3.5	3.1	3.5	4.8
Median		57.00	62.00	115.00	67.00	56.00	55.00	53.00	64.00
Percentiles	10	39.40	36.40	94.00	34.60	25.00	22.60	21.80	30.20
	20	43.60	45.80	99.60	40.60	37.60	34.20	35.20	40.20
	30	48.40	48.40	106.40	48.40	44.40	42.00	41.00	50.00
	40	53.00	55.20	110.20	54.20	51.20	48.00	46.00	59.20
	50	57.00	62.00	115.00	67.00	56.00	55.00	53.00	64.00
	60	61.00	65.80	117.80	72.80	61.00	58.80	60.80	68.80
	70	68.20	71.60	120.00	78.60	70.00	70.60	65.80	81.20
	80	73.00	79.60	121.40	86.80	83.00	74.20	80.20	100.00
	90	85.80	86.00	124.00	98.20	95.80	92.00	96.20	115.20

Notes as shown under Table-5. SD – standard deviation; SEM standard error of mean. FEF75% - amount of air expelled from the lungs during the first 75% of the forced vital capacity.

abnormalities. Table-6 compared the values between normal and restrictive lung function and Table-7 showed the comparisons between normal and obstructive ones. Both the tables showed significant differences of spirometry values between normal and restrictive; and between normal and obstructive lung functions.

Descriptive statistics of spirometry values of a sub-sample of the JMWs are shown in Table-8. The spirometry values represent the status of lung functions of the participants.

High Resolution Computerized Tomography (HRCT) was done in participants with restrictive and obstructive disorders. The HRCT findings were mostly helpful in diagnosing the restrictive cases, where fibrosis was evident. Mild to moderate obstruction could not be detected by HRCT though very severe obstruction was detected as evidenced by hyperinflation.

Discussions

This study is the first one that addressed the health of jute mill workers encompassing not only the respiratory illnesses but also other non-communicable diseases. The prevalence rates of byssinosis like syndrome, observed in this study, are consistent with other study [2,3]. But the complaints of chest tightness symptoms observed in this study was much higher (25.7%) than found by Saha et.al (5.1%) [9]. However, Mandal and Majumder reported even much higher rate (33.49%) of chest tightness among jute mill workers from West Bengal, India [10]. A study from Benin, Africa reported the prevalence of chronic cough, breathlessness (dyspnea), asthma and chronic bronchitis as 16.8%, 17.3%, 2.6%, and 5.9% respectively among textile workers exposed to cotton dust [11]. The findings are almost similar to our observations. The prevalence of obstructive lung disease was much less (0.8%) than that of other studies (17% - 28%) [12]. It may happen that the workers suffering from chronic obstructive pulmonary disease (COPD) are considered disable and removed from job. Thus, the prevalence of COPD among our study population was found low.

The term byssinosis has been used for long time to denote an obstructive airway disease due to inhalation of dust from cotton, flax, hemp, or jute, though it's diagnostic criteria are ill defined. Garson Hollander reported first (1953) a case of *byssinosis* [13]. Its diagnosis was based on "careful history" (chest tightness, breathlessness, chronic cough) and the chest x-ray showing pulmonary tuberculosis like appearance. No matter how carefully the histories are taken from such suspected cases, these symptoms are likely to vary and the diagnostic validity may be challenged. It may be suggested that the term *byssinosis* or the criteria for its diagnosis needs evaluation and should be based on objective scientific evidence and methods.

Most of the studies related to organic dust exposure, whether be it jute or cotton or silk, addressed only respiratory or ventilatory functional disorders. But, the illnesses of workers of these industries are not confined only to respiratory diseases. The other systemic illnesses need to be investigated. Our study not only addressed the respiratory diseases, but also focused into other systemic illnesses, which we considered important to assess the overall health of JMWs. The questions remained unanswered how healthy they are. It may be noteworthy to cite a report published online by Pyakurel *et al* from Nepal on "Catastrophic health expenditure among industrial workers" [14]. We emphasize that the industrial workers' health need comprehensive care (promotive, preventive, curative and rehabilitative), keeping in mind that they are indeed low paid marginalized section of the society. It is not known however, how many of the workers lose their jobs due to illnesses and disabilities.

This study had some important limitations. Many reports stressed that the exposure to both inhalable organic dust and airborne endotoxin are responsible for the pathogenesis of respiratory illnesses observed in cotton workers [15-17]. It may be mentioned that *retting* of jute is a special process where jute is soaked in a mixture of oil and water at 25^0C for 48 hours. The bacteria that grow during the process help in softening and easy separation of individual fiber from the jute sticks. However, these bacteria also produce endotoxin. The workers handling this process are therefore, likely to be exposed to the bacterial endotoxin. This endotoxin has been reported to cause lung tissue damage [15]. In the present study, we could not measure the endotoxin level in work place of the JMWs where they were likely to get exposed to it.

As the jute mill workers are exposed to sound pollution, generated from looms, they are possibly at risk of developing hearing problem and mental irritability [18]. We could not assess these health problems. We also could not assess the ocular, auditory, dermal, musculoskeletal and mental illnesses. Had we performed the spirometry for all participants we could have more accurate rate of abnormal ventilatory functions of the JMWs. Physical activities were assessed using a crude estimation considering "x" min walking equivalent. It would have been better if we could assess their diet. Despite all those limitations this study explored some important information on health and diseases status of the JMWs.

Conclusions

This study concludes that a sizeable proportion of industrial workers, exposed to organic dust, have

been suffering from respiratory illnesses. In addition, the study has revealed that a substantial number of this population suffers from undiagnosed hypertension, diabetes and other non-communicable diseases. They also bear the brunt of undetected cardiovascular risk like dyslipidemia. It was not possible to determine the ocular, auditory, musculoskeletal and mental health problems. This study suggests that a well designed study should be undertaken addressing the limitations mentioned above.

Acknowledgement

We are grateful to the authority of Latif-Bawany Jute mill for their assistance in arranging the site of investigation and giving the list of participants in such a way that the production in the mill remained uninterrupted. We are also very much grateful to the participants volunteering the study.

Contribution of Authors

MMR: Project supervision, questionnaire designing data collection and entry; MAHGM: Performed biochemical tests; MAS: Study design, questionnaire preparation, data analysis and manuscript writing.

Conflict of Interest

None.

Funding

This study was financed by Ibrahim Medical College Research Fund.

Reference

1. Annual Report. India: National Institute of Occupational Health; National Institute of Occupational Health. 1985-86, 1986-87, 1987-88.
2. Chattopadhyay BP, Alam J, Bandyopadhyay B, Gangopadhyay PK. Study to evaluate the occurrence of byssinosis among jute mill workers by clinical history and acute and chronic changes of forced expiratory volume. *Indian J Environ Prot*. 1993; **13**: 903–908.
3. Chattopadhyay BP, Saiyed HN, Alam J, Roy SK, Thakur S, Dasgupta TK. Inquiry into occurrence of Byssinosis in jute mill workers. *J Occup Health*. 1999; **41**: 225–31.
4. Chatterjee BP, Alam J, Gangopadhyay PK. A study of dynamic lung function in jute mill workers. *Indian J Indus Med*. 1989; **35**: 157–165.
5. Bangladesh Bureau of Statistics (BBS) Statistics and Informatics Division (SID) Ministry of Planning. www.bbs.gov.bd.
6. Quanjer PH, Stanojevic S, Cole TJ, Baur X, Hall GL, Culver BH, et al. Multi-ethnic reference values for spirometry for the 3-95-yr age range: the global lung function 2012 equations. *Eur Respir J*. 2012; **40**(6): 1324-1343.
7. Niven R McL, Pickering CAC. Byssinosis: a review. *Thorax*. 1996; **51**: 632-637.
8. Pellegrino R, Viegi G, Brusasco V, Crapo RO, Burgos F, Casaburi R, et al. Interpretative strategies for lung function tests. *Eur Respir J*. 2005; **26**(5): 948-68.
9. Saha A, Das A, Chattopadhyay BP, Alam J, Dasgupta TK. A Comparative study of byssinosis in jute industries. *Indian J Occup Environ Med*. 2018; **22**(3): 170-176.
10. Mandal (Majee) A, Majumder R. Pulmonary function of jute mill workers from West Bengal, India. *Prog Health Sci*. 2014; **4** (1): 7-17.
11. Hinson AV, Lokossou VK, Schlünssen V, Agodokpessi G, Sigsgaard T and Fayomi B. Cotton dust exposure and respiratory disorders among textile workers at a textile company in the Southern Part of Benin. *Int J Environ Res Public Health*. 2016; **13**(9): 895.
12. Er M, Emri SA, Demir AU, Thorne PS, Karakoca Y, Bilir N, Baris IY. Byssinosis and COPD rates among factory workers manufacturing hemp and jute. *Int J Occup Med Environ Health*. 2016; **29**(1): 55-68.
13. Hollander G. Byssinosis. *Chest J*. 1953; **24**(6): 674-678.
14. Pyakurel P, Tripathy JP, Minn Oo M, Achrya B, Pyakurel U, et al. Catastrophic health expenditure among industrial workers in a large-

scale industry in Nepal, 2017: a cross-sectional study. *BMJ Open*. 2018; **8**(11): e022002.

15. Christiani DC, Ye TT, Zhang S, Wegman DH, Eisen EA, Ryan LA, et al. Cotton dust and endotoxin exposure and long-term decline in lung function: Results of a longitudinal study. *Am J Ind Med.* 1999; **95**: 321–331.
16. Mayan O, Torres Da Costa J, Neves P et al. Respiratory effects among cotton workers in relation to dust and endotoxin exposure. *Ann Occup Hyg*. 2002; **46**: 277–280.
17. Smit LAM, Heederik DJJ, Doekes G, Lammers J-WL, Wouters I. Occupational endotoxin exposure reduces the risk of atopic sensitization but increases the risk of bronchial hyperresponsiveness. *Int Arch Allergy Immunol*. 2010; **152**: 151–8.
18. Roggia SM, de França AG, Morata TC, Krieg E, Earl BR. Auditory system dysfunction in Brazilian gasoline station workers. *Int J Audiol*. 2019; **24**: 1-13.